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ABSTRACT

This is one form of three performance checks booklets (A, B, and C) for Level II of the Intermediate Science Curriculum Study (ISCS). The three booklets are considered one of four major subdivisions of a set of individualized evaluation materials for Level II of the ISCS. This booklet (form A), developed to assess the students' achievement of the objectives of Level II, contains a set of performance checks equivalent to the performance checks of the other two forms (B and C). Each performance check has its own code number which indicates the unit number and identifies whether it is based on core material or excursions. Directions for students' use of performance checks are also included. (HM)

INTERMEDIATE SCIENCE CURRICULUM STUDY

INDIVIDUALIZED TESTING SYSTEM

Performance Checks
ISCS LEVEL II
FORM A

SILVER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey · Park Ridge, Ill. · Palo Alto · Dallas · Atlanta

INDIVIDUALIZED TESTING SYSTEM

ALL LEVELS	**Individualizing Objective Testing** (an ITP module) **Evaluating and Reporting Progress** (an ITP module)
LEVEL I	**Performance Objectives**, ISCS Level I **Performance Checks**, ISCS Level I, Forms A, B, and C **Performance Assessment Resources**, ISCS Level I, Parts 1 and 2
LEVEL II	**Performance Objectives**, ISCS Level II **Performance Checks**, ISCS Level II, Forms A, B, and C **Performance Assessment Resources**, ISCS Level II, Parts 1 and 2
LEVEL III	**Performance Objectives**, ISCS Level III **Performance Checks**, ISCS Level III, ES-WB, Forms A, B, and C WYY-IV, Forms A, B, and C IO-WU, Forms A, B, and C WW-CP, Forms A, B, and C **Performance Assessment Resources**, ISCS Level III, ES-WB WYY-IV IO-WU WW-CP

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FOREWORD

To implement an educational approach successfully, one must match the philosophy of evaluation with that of instruction. This is particularly true when individualization is the key element in the educational approach. Yet, as important as it is to achieve this match, the task is by no means simple for the teacher. In fact, without specific resource materials to help him, he is apt to find the task overwhelming. For this reason, ISCS has developed a set of individualized evaluation materials as part of its Individualized Teacher Preparation (ITP) program. These materials are designed to assist teachers in their transition to individualized instruction and to help them tailor their assessment of students' progress to the needs of all their students.

The two modules concerned with evaluation, *Individualizing Objective Testing* and *Evaluating and Reporting Progress,* can be used by small groups of teachers in in-service settings or by individual teachers in a local school environment. Hopefully, they will do more than give each teacher an overview of individualized evaluation. These ITP modules suggest key strategies for achieving both subjective and objective evaluation of each student's progress. And to make it easier for teachers to put such strategies into practice, ISCS has produced the associated booklets entitled *Performance Objectives, Performance Assessment Resources,* and *Performance Checks.* Using these materials, the teacher can objectively assess the student's mastery of the processes, skills, and subject matter of the ISCS program. And the teacher can obtain, at the moment when they are needed, specific suggestions for remedying the student's identified deficiencies.

If you are an ISCS teacher, selective use of these materials will guide you in developing an individualized evaluation program best suited to your own settings and thus further enhance the individualized character of your ISCS program.

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NOTES TO THE STUDENT

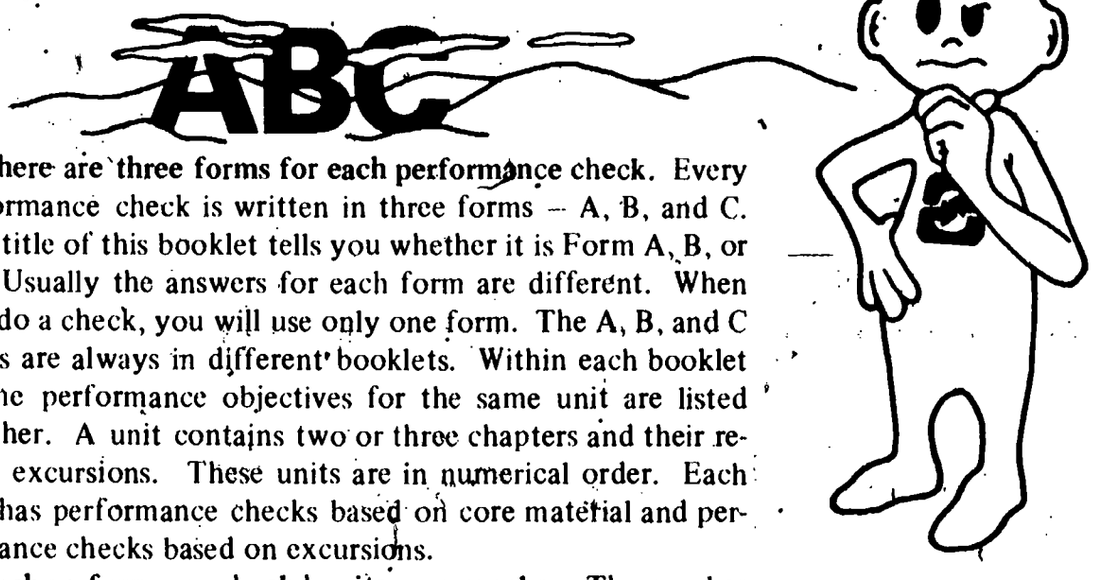
Now that you have completed several chapters, excursions, and self-evaluations, you are ready to help your teacher determine how well you are doing. The performance checks in this book will provide your teacher with this information. Then your teacher can help you with things you may not understand and can keep a record of your progress.

Read the next section carefully. It explains some important things about the performance checks in this book, and it gives you specific suggestions for using them.

What You Need To Know about Performance Checks

1. **You do performance checks when you are ready.** Performance checks are somewhat like the questions in the self-evaluations – you do them when you are ready, not when the whole class is ready.

2. **Your teacher or both of you decide how many you do.** Your teacher or you and your teacher together will decide which ones you should do. You are not expected to do all of the performance checks.



3. **There are three forms for each performance check.** Every performance check is written in three forms – A, B, and C. (The title of this booklet tells you whether it is Form A, B, or C.) Usually the answers for each form are different. When you do a check, you will use only one form. The A, B, and C forms are always in different booklets. Within each booklet all the performance objectives for the same unit are listed together. A unit contains two or three chapters and their related excursions. These units are in numerical order. Each unit has performance checks based on core material and performance checks based on excursions.

4. **Each performance check has its own number.** The number is in the outside margin of the page and will look like this: 03-Core-17A or 05-Exc 17-2-2A. These numbers mean

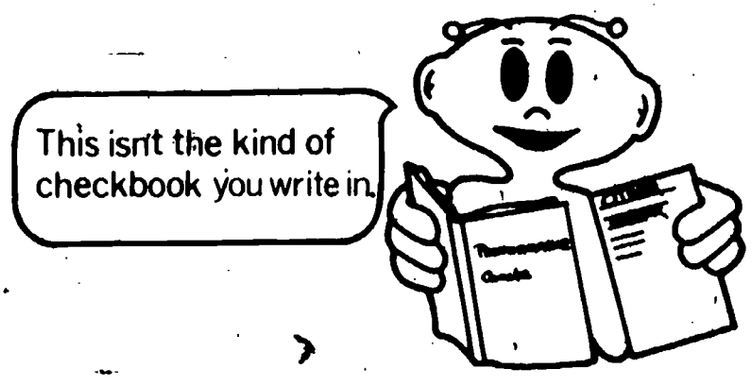
03	-	Core	-	17	A	and	05	-	Exc	17-2	-	2	A
unit		based on core material		check number	form of the check		unit		material	based on excursion		excursion number check number	form of the check

5. **Each performance check is separated from the other.** There is a line before each performance check and one after it. Some performance checks have several parts, so do everything called for between the lines. If there is no line at the bottom of a page, the check is continued onto the next page.

6. **Sometimes you will need to use equipment.** If special materials are needed, they will be in boxes labeled with the same number and sometimes the same letter too as the performance check for which you need them.

7. **Some performance checks have two or more answers.** If more than one answer in correct, you must select all the correct choices. In such cases selecting just one answer is not enough.

8. **Some performance checks have no answers.** Occasionally, you may be asked to do something that is impossible and to explain your answer. If so, say that the task is impossible and explain why.



9. **You share books of performance checks and YOU DO NOT WRITE IN THEM.** Write your answers on other paper. Give the number and form of the performance check for each answer you write. If you are to draw a graph, your teacher may provide you with grid paper.

10. **Your teacher or his assistant will collect and mark your checks.** And sometimes you must ask him to watch or assist you as you do a check.

11. **Sometimes a review procedure will be suggested.** If you can't do a performance check, you may be asked to review a part of the text or a self-evaluation question. You may then be checked on the same material, so be sure you understand the material you review. Get help if you need it.

An unmanned spacecraft landed on Mars and sent back only the following information about two samples, X and Y, found on the surface. Nothing else is known about them. **01-Core-1A**

1. Can you be certain that samples X and Y are different substances?
2. Explain your answer.

	SAMPLE X	SAMPLE Y
Color	white	white
Texture	rough	smooth
Volume	8 cc	9 cc
Luster	dull	dull

If someone splashes an unknown or a dangerous solution on himself or someone else, what two things should he do? **01-Core-2A**

Get any materials you need in addition to those in box 01-Core-3 to complete this item. Place ¼ of a teaspoon of powder from the bag into a beaker. Add about 5 drops of the acid in bottle B to the powder. Record the observations that you make. **01-Core-3A**

Get a piece of rock, a shell, and enough of the powder in the bottle labeled 01-Core-4A to cover the bottom of a test tube. You may use any or all of the following equipment that you need – a beaker, a balance, a magnifying glass, a bottle of hydrochloric acid (HCl), and safety glasses. **01-Core-4A**

1. Is the powder more like rock or like shell?
2. Explain your answer.

Get two baby-food jars. Label one X and the other Y. From the supply area, get the two bags labeled 01-Core-5X and 01-Core-5Y. Take a small sample of powder from each bag. Also get a dropper bottle of hydrochloric acid (HCl). If your room has an acid area, do your test there. **01-Core-5A**

1. Which sample is rock powder?
2. Which sample is shell powder?
3. How did the observations you made allow you to identify which powder came from rock and which powder came from shell?

Tony has a solid material. If he ground it to a powder, which of the following would change the least? **01-Core-6A**

a. Its roughness
b. Its glass-like appearance
c. Its shape
d. Its reaction with HCl

01-Core-7A.

1. Draw a diagram which shows what you would expect to see if you could shrink to a size small enough to walk around inside a piece of pure copper.
2. Explain your diagram.

01-Core-8A

Select the best answer below. Scientific models are

a. statements of the way matter and energy really are inside of materials.
b. statements of what the best scientists have observed with their own eyes.
c. creations of the minds of people, made up to explain observations.
d. unchangeable facts.

01-Core-9A

Record the letters of all statements below which are part of the particle model of matter.

a. Matter particles can move.
b. All matter is composed of one kind of matter particle.
c. Matter particles move at a constant speed.
d. Matter particles have energy.
e. Matter is made up of particles.

01-Core-10A

Select the letter of the choice below which best completes the statement. A scientific model

a. always provides correct answers to scientific questions.
b. is used because it helps to explain observations and to predict other observations, not because it is known to be correct.
c. states what happens in nature and therefore is correct.
d. is always thrown out when it has failed to predict a new observation or when it does not explain a new observation because the model has been shown to be incomplete.

01-Core-11A

Select the statements which are true about a scientific model.

a. It explains observations.
b. It can include a physical object or a set of objects, such as blocks and wire.
c. It is an observation.
d. It can be a mental picture.

01-Core-12A

Copy the numbers of the words below onto your paper. Tell whether each substance is found at ordinary room temperature as a solid, a liquid, or a gas. Write S (for solid), L (for liquid), or G (for gas) after its number on your paper.

1. Oil
2. Rubber
3. Iron
4. Oxygen
5. Cola
6. Milk
7. Nylon
8. Air

01-Core-13A

A scientific model is very useful to a scientist. Name two things that a scientific model does for a scientist.

What is *mass*? **01-Core-14A**

Copy the list of words below. After those things which are made up of particles, place a P. After those things which are matter, place an M. You may place both an M and a P after a word. **01-Core-15A**

1. Paper
2. Nickel
3. Ink
4. Idea
5. Hydrogen

On your paper, copy the five words listed below. Place an M after those things which have mass. Place an X after those things made up of matter. You may place both an M and an X after a word. **01-Core-16A**

1. Meat
2. Idea
3. Film
4. Air
5. Rainbow

Suppose you were asked to show that oxygen is matter. What would you have to show about oxygen to prove that it is matter? **01-Core-17A**

Get a balance and a set of gram masses. Then, from box 01-Core-18, get a small test tube and a sinker. Find the mass of each of the objects from the box as closely as possible. Write the name of each object and its mass on your answer sheet. **01-Core-18A**

If an air piston contains 25 cc of water, what is the volume of the water in ml? **01-Core-19A**

Get bottle 01-Core-20A, and fill it with water to the line marked on the side. Use a graduated cylinder to determine the volume of water in the bottle. **01-Core-20A**

John pumped up his bicycle tire, using a gas. **01-Core-21A**

1. Is the gas in the tire matter?
2. How do you know?

Get a 10 cc air piston and a 50 ml beaker ½ full of water. Hold the piston away from the beaker and pull the plunger back. Put the tip of the piston under the water, and push the plunger forward. What, if any, is the state or form of matter coming from the piston? **01-Core-22A**

01-Core-23A On the sketch provided by your teacher, mark the place in your ISCS room where each of the following is normally stored.

1. Bucket of sand
2. Fire blanket
3. Safety goggles
4. CO_2 or soda-acid fire extinguishers
5. First-aid kit

01-Core-24A Your teacher will observe you for this check when he can.

01-Core-25A Your teacher will observe you for this check when he can.

01-Core-26A Your teacher will observe you for this check when he can.

01-Core-27A Your teacher will observe you for this check when he can.

01-Core-28A Your teacher will observe you for this check when he can.

01-Exc 2-2-1A Listed in Column A below are six quantities commonly measured in science. Copy them onto your paper.

From Column B, choose the metric unit used to express each of these quantities and write it on your paper after the quantity it matches.

Column A (Quantities)	Column B (Units)
1. Mass	gram/milliliter
2. Volume	meter/second
3. Speed (distance/time unit)	pound
4. Temperature	cm/second
5. Length	gram
6. Density (mass/unit volume)	quart
	foot
	°C
	liter
	°F
	centimeter
	pound/cu ft

01-Exc 2-3-1A Suppose that in the year 2001 A.D. you are asked to lead a team of astronauts to the planet Snoopy in a distant solar system. State two of the three things which would determine your weight on the planet Snoopy.

Select the letter of the property of a solid that would be different on the earth, the moon, and Mars. **01-Exc 2-3-2A**

a. Weight
b. Mass
c. Volume
d. Color

Write the letter of the choice below which lists the important factors that determine your weight on earth. **01-Exc 2-3-3A**

a. Your mass, volume, and distance from the center of the earth
b. Your mass and distance from the center of the earth, and the earth's mass
c. Your mass and volume, and the earth's mass
d. None of these

Get jars B and C from box 02-Core-1 at the supply area. What is the state of matter, if any, in each of the jars? **02-Core-1A**

Two scientists reported their research. They described their experiments and said they had done exactly the same experiment. However, the results and conclusions of one scientist were completely different from the results and conclusions of the other. They argued that one of them had done something that was different from what he said he had done. **02-Core-2A**

1. Is it possible that they both actually did do exactly the same experiment?
2. Explain your answer.

Ann mixed two chemicals. A gas was given off. The gas put out a burning match. When asked if the gas was carbon dioxide, Ann said, "It might be, but I don't know for sure." **02-Core-3A**

1. Was Ann right in saying that she could not tell what the gas was even though she had tested it with the burning match?
2. Explain your answer.

Operational definition I: Carbon dioxide (CO_2) is a gas which puts out fires, turns phenol red to yellow, and turns limewater milky. **02-Core-4A**

Operational definition II: CO_2 is a gas which is colorless, odorless, and tasteless.

Operational definition II says CO_2 can be detected or identified by observing the properties of the gas itself. It takes less work than the first operational definition.

1. Is operational definition II as useful as operational definition I?
2. Explain your answer.

Becky tested a bottle of atron and a bottle of batrogen. Her data are given in the table below. **02-Core-5A**

TEST	GAS	
	Atron	Batrogen
Reaction with a certain solution	turns red	turns red
Reaction with a lighted match	burns explosively	burns explosively
Effects on the nose	smells bad and stings	smells bad and stings
Reaction with phenol red	turns it yellow	turns it green

She then operationally defined *atron gas* as a gas which (1) turns a certain solution red, (2) burns explosively, and (3) has a bad smell and stings her nose.

1. Is this a good operational definition for *atron*?
2. Explain your answer.

02-Core-6A All the statements below are true. Record the letters of any of the statements which are operational definitions.

a. Oxygen is a gas that causes a glowing splint to burst into flame when the splint is placed into a container of the gas.
b. Chlorine is one of several greenish poisonous gases.
c. Nitrogen is a colorless, odorless, tasteless gas.
d. Iodine is a purple gas that forms when a substance that contains it is heated.

02-Core-7A Consider the following facts.

a. Lithium particles are present in many substances.
b. Most substances containing lithium particles are white.
c. Substances containing lithium turn a flame a bright red color.
d. Substances containing lithium, potassium, and sodium particles have a high boiling point, and dissolve very easily in water.

Choose the one statement above that is an operational definition for *lithium*.

02-Core-8A John put some hydrochloric acid on baking soda and on coral. In both cases bubbling occurred. John collected some of each of the resulting gases. In both cases the gas turned limewater cloudy and put out fires quickly. How could such different substances as baking soda and coral both produce gases which react the same way?

02-Core-9A Samples of air, hydrogen, carbon dioxide, and an unknown gas were tested. The results are shown in the table below. List the sample numbers on your paper. After each number, write the name of the gas in the sample.

GAS TESTED	TEST RESULTS		
SAMPLE	PHENOL RED	LIMEWATER	BURNING MATCH
1	turns it yellow	turns it cloudy	puts it out
2	no change	no change	keeps it burning
3	no change	no change	explodes
4	turns it clear	no change	puts it out

02-Core-10A

1. Name the products in the reaction below.
2. Name the reactants in the reaction below.

calcium + sulfuric acid → hydrogen + calcium sulfate

02-Core-11A Write a word statement for the following chemical reaction. Calcium chloride, water, and carbon dioxide are formed when calcium carbonate reacts with hydrochloric acid.

02-Core-12A Copy the list of words below onto your answer sheet. Place a G after the things which are gases. Place an M after those things which are matter. You may place both a G and an M after a word.

1. Ice
2. Oxygen
3. Wind
4. Air
5. Carbon dioxide

Louie did the reactions below which involved hydrochloric acid (HCl). **02-Core-13A**

1. red solid + HCl → greenish gas (1) + colorless liquid
2. orange solid + HCl → greenish gas (2) + colorless liquid
3. yellow solid + HCl → yellow solid (3) + colorless liquid
4. amber solid + HCl → greenish gas (4) + colorless liquid

He then tested the gases and collected the data below.

GREENISH GAS	BURNED	ODOR	COLOR IN TARTON SOLUTION
1	slowly	sharp	pink
2	exploded	none	blue
4	slowly	sharp	pink

Which of the solid reactants – red, orange, and amber – in the reactions above probably contain similar matter particles?

Select any of the procedures below in which a control is used. **02-Core-14A**

a. Gail put a solid into a beaker of water. She heated the solution to increase the speed at which the solid dissolved. The solid dissolved.

b. Ron heated solid, blue copper sulfate. It turned white, and something that looked like water came out of the test tube. He didn't have any plain water, but he had a colorless salt solution handy. He added half the salt solution to the white crystals to see if it was water that had been given off. They turned blue.

c. Bobbie wanted to see if a new plant food she bought really worked. She added the plant food to one tray of tomato plants which she watched grow. The tomato plants grew very well.

d. Cathy wanted to know whether beans cooked faster covered or uncovered. She opened a can of beans and put half the beans into each of two aluminum pans. She turned both burners to the same temperature. She covered one of the pans. The other she left uncovered. The covered beans cooked faster.

In an experiment, what is a control? **02-Core-15A**

Why is a control used when an experiment is being done? **02-Core-16A**

You are a famous scientist. A friend wants you to find out what matter particles are in an unknown material which has never been studied before. What would you need to do to identify the matter particles in the unknown material? **02-Core-17A**

02-Core-18A

Theron blue turns pink if X matter particles are present. Braten orange turns green if Y matter particles are present. Theron blue solution is put into four test tubes. Braten orange solution is put into four other test tubes. A small amount of solution 1, 2, 3, or 4 is added to each sample of braten orange and theron blue. The results are shown in the table below.

SOLUTION ADDED	THERON BLUE	BRATEN ORANGE
1	turns pink	no change
2	no change	turns green
3	no change	no change
4	turns pink	turns green

Select any of the following which agree with the data in the table.

a. Solutions 1 and 2 contain the same matter particles.
b. Solutions 1 and 3 contain Y type matter particles.
c. Solutions 1 and 4 contain X type matter particles.
d. Solutions 2 and 3 react with theron blue.
e. Solution 4 contains just X type particles.

02-Core-19A

Suppose that the total number of different materials is known to be one trillion.

1. Is the number of different kinds of matter particles more than, less than, or equal to one trillion?
2. What evidence supports your answer?

02-Exc 3-1-1A

What do the reactions below indicate to you about the makeup of the three solutions?

hydrochloric acid (solution) + seashells → carbonic acid
lemon juice (solution) + seashells → carbonic acid
vinegar (solution) + seashells → carbonic acid

02-Exc 4-1-1A

There are many variables in the problem below. Name the variable which changes because other things are changed on purpose.

Problem: A tire manufacturer wants to know which of three kinds of cord material will help his tires get the best mileage.

02-Exc 4-1-2A

In the following problem, identify at least two variables which must be kept constant if the experiment is to have usable results.

Problem: A gasoline refiner wants to know which of three additives will cause his gasoline to give the best mileage.

02-Exc 4-2-1A

In Excursion 4-2, you learned a new, more sensitive procedure for detecting the presence of iodine. Describe the main parts of that procedure. If you would like to review the less sensitive procedure, you may look at page 55 in your text.

In Excursion 4-3, you burned turpentine, Styrofoam, and wood. Each produced soot (carbon), carbon dioxide gas, or both. There are thousands of substances in the world which produce these same results when burned. What conclusion about the contents of these substances can you make?

Copy the list of words below onto your paper. Write E after those things which are made up of elements or combinations of elements. Write M after those things which are made up of matter. You may put an E and an M after the same word. **03-Core-1A**

1. Window glass
2. Leather
3. Wood
4. Space
5. Light

What term is used to name a substance made up of one and only one kind of atom? **03-Core-2A**

What is the name of the matter particles which make up elements? **03-Core-3A**

Each different shape in the diagrams below represents a different kind of atom. Which diagram best represents an element? **03-Core-4A**

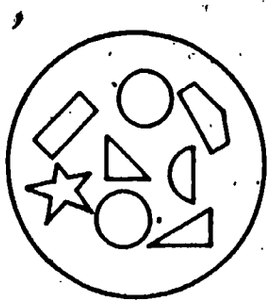
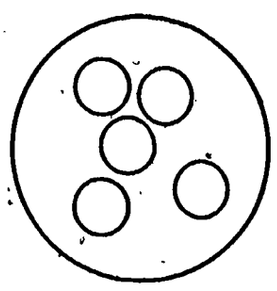


Diagram a



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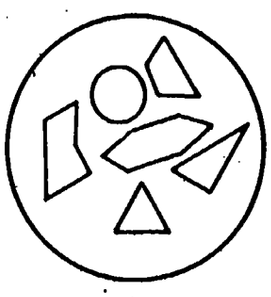


Diagram c

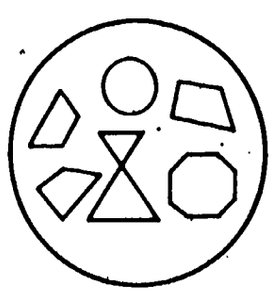


Diagram d

Copy the list of words below onto your paper. Write M after those things which are matter. Write A after those things which are made up of atoms. You may put both an M and an A after a word. **03-Core-5A**

1. Paper
2. Your
3. Ideas
4. Breath
5. Cloth

John has samples of 21 different elements. According to the model you and Iggy developed for matter, how many different kinds of atoms does John have? **03-Core-6A**

a. About 6 or 7
b. 21
c. 42
d. Several billion
e. Impossible to tell

03-Core-7A How many materials are there that cannot be broken down into other materials by chemical means?

a. About 5
b. About 90,000
c. About 2,000
d. About 100

03-Core-8A Draw a diagram which shows what you would expect to see if a small piece of the element silver were magnified enough for you to see the atoms. Explain your diagram.

03-Core-9A In the formula for calcium chloride ($CaCl_2$), Ca is the symbol for the element calcium. How many kinds of atoms does the symbol Ca stand for?

03-Core-10A Iggy has a nut and bolt combination made up of two long bolts (Bo), one yellow nut (Ye), and four green nuts (Gr). Select the formula below which fits Iggy's combination.

a. $2BoYe_4Gr$
b. $2BoYeGr_4$
c. Bo_2YeGr_4
d. $Bo_2Ye_4Gr_2$
e. Bo_4YeGr_2

03-Core-11A Don represented four combinations of two kinds of nuts (Re and Gr) and two kinds of bolts (Ye and Bl) by the formulas given below. Write the total number of parts represented in each formula.

1. $GrRe_2Bl_2$
2. Gr_3Ye
3. Re_3Ye_2
4. $GrBl$

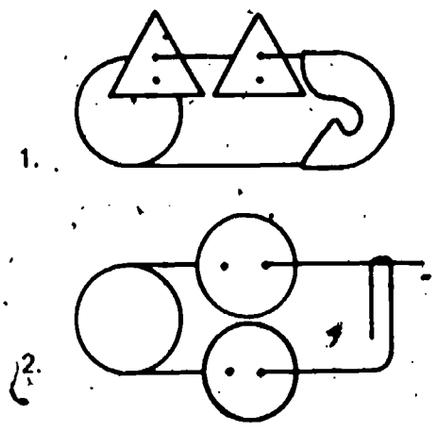
03-Core-12A Jim used the symbols Bl for long bolts and Sq for square nuts. When he put a pile of nuts and bolts together in a certain way, his combination was $3Bl_2Sq_5$.

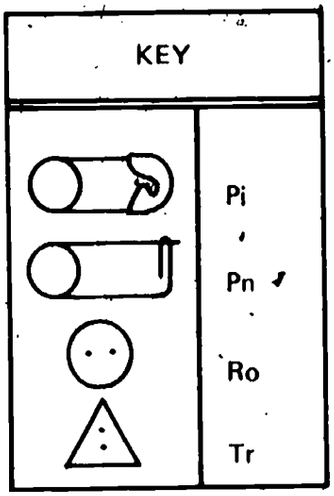
1. How many square nuts were in each unit of the combination?
2. How many units of the combination did Jim make?
3. How many long bolts were present in the total number of units of the combination formed?

03-Core-13A Using your knowledge of symbols, formulas, elements, and particles, answer this question. How many different kinds of particles are in each of the following formulas?

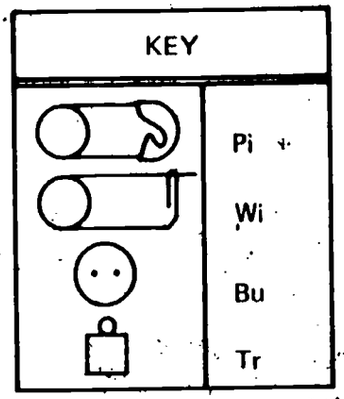
1. K_2MnF_6
2. $OsCl_4$

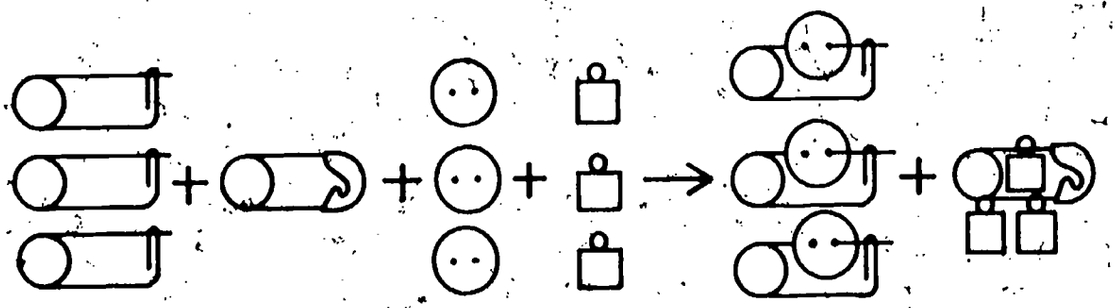
Using the key shown below, write the formula for each of the two pin-button combinations pictured. **03-Core-14A**





Describe the reaction below in terms of symbols and numbers. The key shows the symbols for the pins and buttons used. **03-Core-15A**





Bo_2HxSq_2 is the formula for a nut and bolt combination. What does the formula tell you about the order in which the parts are combined? **03-Core-16A**

03-Core-17A Select any of the choices below which will complete the sentence. Neal brought a sample of black substance to his science teacher. It is possible that the substance contains ____ kind(s) of atoms.

a. 2
b. 5
c. 1
d. a or c
e. a, b, or c

03-Core-18A Louie was given a blue rock and asked to find out which elements were in it. Todd said that it was impossible to identify the elements in the rock because there are millions of different substances, so there must be millions of different elements. Louie said that it is possible to identify the elements in anything.

1. Do you agree with Louie or Todd?
2. Explain why the person you agree with is correct.

03-Core-19A You and Iggy have developed a particle model. It says that only a small number of different kinds of atoms are needed to make all of the substances we know. How can this be true?

03-Core-20A John dissolved salt in water, instant tea in water, and iodine in alcohol. What are the mixtures John formed called?

03-Core-21A When solid sodium nitrate is added to water and the two are stirred, the solid disappears. What happens to the solid?

03-Core-22A When 7 grams of solid, blue copper sulfate are dissolved in 32 grams of a liquid, the solid disappears and the liquid becomes bluish. The weight of the solution is 39 grams.

1. The number of atoms present in the 7 g of copper sulfate and the 32 grams of liquid before dissolving is (equal to, greater than, or less than) the number of atoms present in the 39 grams of solution. Choose the phrase in parentheses which completes the sentence correctly.
2. Explain your answer.

03-Core-23A Shelly has a beaker of a solution. She tests a 20 ml sample of it and finds that it contains a dissolved solid. She says she cannot be sure if the rest of the liquid contains the dissolved solid because she has tested only a sample.

1. Could other samples of the liquid be different?
2. Explain your answer.

03-Core-24A Cover the bottom of a test tube with blue copper sulfate crystals and sodium chloride. Have your teacher check the amount of the solid you have in the test tube. Use an alcohol burner and any other materials you need, and heat the substance for two minutes. List your observations.

Jerry mixed a blue solution and a colorless solution and produced a solid and a green-blue solution. What happened to the atoms of the reactants to make the products so different from the reactants? **03-Core-25A**

Bob was given a sample of a white element and a red element. He knew that the white element would react with many other elements. He knew nothing about the red element. He put them both into a test tube and heated them, but no reaction took place. Bob decided that the red element wouldn't react with any element because it did not react with the white element. **03-Core-26A**

1. Do you agree with his conclusion?
2. Explain your answer.

John prepared the following reaction. **03-Core-27A**

zinc + hydrochloric acid → zinc chloride + hydrogen

If there were 755 atoms of zinc used as reactants how many atoms of zinc are present in the products?

a. Exactly 755
b. Probably 755 plus a few
c. Probably 755 minus a few
d. Impossible to tell
e. Either b or c

When hydrogen sulfide is added to silver nitrate solution, the silver atoms combine with the sulfide particles to form a black solid called *silver sulfide*. Sam mixes a solution of hydrogen sulfide with a solution of silver nitrate. The black solid forms and settles to the bottom. How can Sam find out if all of the reactant silver particles are used up? **03-Core-28A**

Jean did the following reaction. **03-Core-29A**

zinc + copper sulfate → 16.1 g zinc sulfate + 6.4 g copper
(22.5 g total product)

1. Select the phrase which makes the following statement true. The mass of the reactants was (greater than, equal to, less than) 22.5 g.
2. Since you weren't there when Jean did the reaction, on what basis could you answer question 1?

03-Exc 5-1-1A

The names of the chemical elements come from a wide variety of sources. Select all of the statements below which account for this variety. The elements were named

a. by the people who used them.
b. for the people who discovered them.
c. for famous people.
d. for gods, goddesses, and goblins.
e. for continents, countries, and cities.
f. by a systematic scientific process.
g. using Greek or German names.
h. for their color.
i. for their odor.
j. for their appearance.

03-Exc 6-1-1A

1. If 75,000 particles of sodium are dissolved in enough water to make 100 ml of solution, how many particles of sodium would you expect to find in a 10 ml sample of the solution?
2. State how the particles are distributed in the solution.

03-Exc 6-2-1A

For each of the four situations below, write the number of the situation and answer these two questions.

(a) Has a chemical reaction occurred?
(b) How do you know?

Situation 1. A colorless solution of chemical A and a colorless solution of chemical B are mixed. No color change is observed in the solution, no gas is released, and a white solid settles to the bottom of the beaker.

Situation 2. When a clear colorless solution X is added to a colorless solution Y, no gas is released in the glass container in which they are mixed. The solution stays clear but turns yellow. No odor is observed.

Situation 3. When hydrochloric acid is added to a colorless solution, bubbles form and escape, no color change is observed, and no solid forms.

Situation 4. Two solids each form a colorless solution when dissolved in water. When the two solutions are mixed, the resulting solution remains clear and colorless. No gas is given off, and no solid settles to the bottom. There is no temperature change.

03-Exc 6-3-1A

When hydrochloric acid is added to silver nitrate, the silver atoms combine with the chloride particles. A white solid, called *silver chloride*, forms. Ken mixes 4 milliliters of HCl with 4 milliliters of silver nitrate. The white solid forms and settles to the bottom. Explain how he could find out if all of the reactant silver particles are used up.

Jack observed the following two reactions. **04-Core-1A**

$2K + I_2 \rightarrow 2KI$
(element) (element) (compound)

$Cu + Cl_2 \rightarrow CuCl_2$
(element) (element) (compound)

He concluded that the elements potassium (K), iodine (I), copper (Cu), and chlorine (Cl) do react, and therefore the following reactions will occur.

$K + Cu \rightarrow KCu$
$Cu + I_2 \rightarrow CuI_2$
$Cl_2 + I_2 \rightarrow 2ClI$
$2K + Cl_2 \rightarrow 2KCl$

1. Do you agree or disagree with Jack?
2. Why?

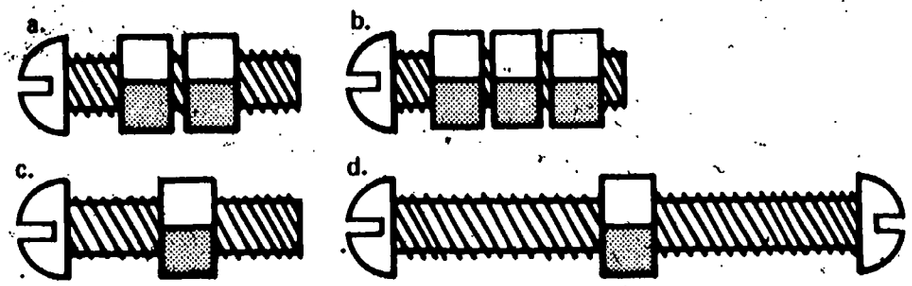
George has a bottle of chloride solution. He puts 2 ml of the solution into a test tube and 10 ml of it into a beaker. There are 20 chloride atoms in the 2 ml of solution in the test tube. How many chloride atoms are in the beaker? **04-Core-2A**

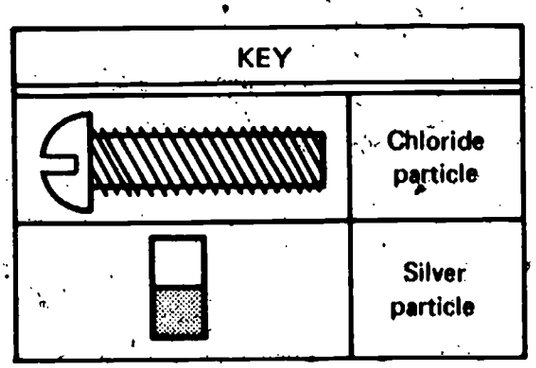
a. You can't tell
b. 20
c. 100
d. 200
e. 2,000

In tests, Dan found that 4 particles of calcium react with 8 particles of chlorine, producing 4 particles of calcium chloride. **04-Core-3A**

1. If Dan is given 10 particles of calcium, can he predict the number of particles of chlorine needed to use up all the calcium particles?
2. Can he predict how many particles of calcium chloride will be produced?
3. Explain your answers.

Jack has two solutions. One contains silver particles, and the other contains chloride particles. Suppose each ml of the chloride solution contained 5 chloride particles, and each ml of the silver solution contained 5 silver particles. He mixes 10 ml of the solution containing silver particles with 10 ml of the solution containing chloride particles. Select any of the combinations below which would cause you to predict that chloride particles would be left over. **04-Core-4A**





04-Core-5A A solution of sodium chloride is added to a solution of lead nitrate. The lead and the chlorine atoms form a white solid, lead chloride, which settles to the bottom. How could you find out if all the lead particles in the lead nitrate solution are used up?

04-Core-6A In Chapter 7, you heated the six test tubes with the yellow solid in them. Then you were given the following directions:

> Measure, in millimeters, the height of the yellow solid that has formed in each tube. The height of the pile of solid indicates the amount of product formed. The longer you wait to make the measurements, the more the solid will settle. Therefore, do your measuring today. And measure all the tubes as quickly, yet as carefully as you can.

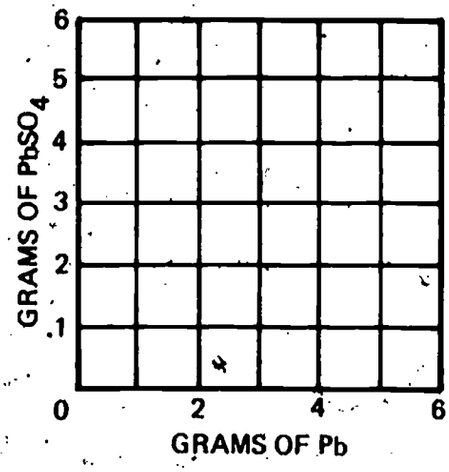
What variable do these directions tell you must be controlled if the results of your activity are to be useful?

04-Core-7A HCl was added to a solution of washing soda solution. The washing soda particles reacted, and bubbles of carbon dioxide gas were given off. How could you find out if there were any more unreacted washing soda particles left?

04-Core-8A Julie combined lead and sulfuric acid in the following reaction. Her data for six trials appear in the table below.

$Pb + H_2SO_4 \rightarrow PbSO_4 + H_2$

(lead) (sulfuric acid) (lead sulfate) (hydrogen)



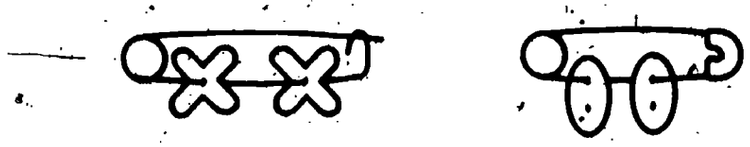
TRIAL	AMT. OF Pb (in g)	AMT. OF H_2SO_4 (in ml)	AMT. OF $PbSO_4$ (in g)
1	1	28	1.5
2	2	28	3.0
3	3	28	4.5
4	4	28	5.0
5	5	28	5.0
6	6	28	5.0

Study the table, and answer the following questions. If it will help you, get a piece of graph paper and plot the data on a grid like the one shown.

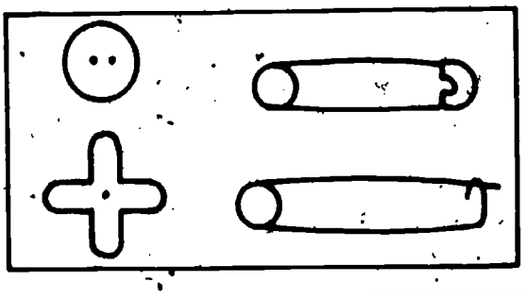
1. In which trials is there an excess of Pb?
2. In which trials is there an excess of H_2SO_4?

04-Core-9A Write a definition of *compound* as it is used in the following sentence. Copper sulfate ($CuSO_4$) is a compound.

Each of the two combinations below represents a different compound. 04-Core-10A



If the diagrams above represent compounds, what does each symbol in the box below represent?



Alice developed a model that explained all the observations involving gravity in terms of a particle, which she called a *graviton*. When three other students brought Alice their models, which they said also explained all observations involving gravity, Alice refused to review them. She remarked, "Your models can't be good. They are different from mine, and everybody knows mine works." 04-Core-11A

1. Do you agree with Alice's reason for not looking at the other models?
2. Explain your answer.

Suppose Iggy has become so small that he can walk between atoms in a material. Iggy is lost inside a chunk of material because all the atoms look exactly alike. What sort of a material is Iggy lost in? 04-Core-12A

Write the letter of the best statement below about the models that scientists use. 04-Core-13A

a. A model is thrown out when it does not predict or explain a new observation because it has been shown to be incorrect or incomplete.
b. Models used by scientists provide only right answers.
c. The models used by scientists state what actually happens in nature and are therefore correct.
d. It is not known if the models used by scientists are correct, but they are used because they help explain and predict observations.

Suppose that all scientists were to accept a particle model for sound. This would mean that 04-Core-14A

a. scientists had direct proof that sound exists as particles.
b. at least the best scientists have seen sound particles.
c. sound is exactly like matter particles.
d. thinking about sound as though it is made up of tiny particles had explained most of the observations made to that date.
e. No other model could explain the observations made to that date.

04-Core-15A

In your text, you were asked whether atoms combine with each other in definite numbers. You said yes after experimenting with lead iodide (PbI_2). Then, instead of being asked a different question, you were asked to answer the same question working with copper sulfate ($CuSO_4$) and zinc (Zn). Why was it necessary to answer the question more than once?

04-Core-16A

SYSTEM

zinc + hydrochloric acid → zinc chloride + hydrogen
(metal) (colorless solution) (colorless solution) (colorless gas)

List the letters of any of the following which represent a component of the above system.

a. zinc + hydrochloric acid
b. zinc + hydrochloric acid → zinc chloride + hydrogen
c. zinc + hydrochloric acid → hydrogen
d. zinc chloride
e. zinc

04-Core-17A

SYSTEM

sodium sulfide + silver nitrate → sodium nitrate + silver sulfide
(colorless solution) (colorless solution) (colorless solution) (black solid)

List the letters of any of the following which represent subsystems of the above system.

a. silver + sulfide → silver sulfide
b. sodium
c. sodium sulfide + silver nitrate
d. sodium nitrate + silver sulfide
e. sodium sulfide + silver nitrate → sodium nitrate + silver sulfide

04-Core-18A

Get the following equipment:

1 alcohol burner
1 250-ml beaker
1 Celsius thermometer
1 burner support stand
150 ml of water

Get your teacher or an appointed observer to watch you. Use the burner to heat the 150 ml of water. While the water is heating, measure and record its temperature every minute for three minutes.

04-Core-19A

Bill found in a reaction that for every atom of calcium (Ca), two atoms of iodine (I) were used. He decided that one atom of Ca always combines with two atoms of I. But Sue said that the number of I atoms that combine with an atom of Ca would be different if Bill had started with different amounts of Ca and I.

1. Do you agree with Bill or Sue?
2. Why?

Ask the teacher to watch you do this performance check. Get bottle 04-Core-20 and weigh out 3 grams of the white solid. You may use any equipment you need. **04-Core-20A**

In box 04-Core-21 you will find eight solutions labeled A through H. Get five test tubes and any equipment you need. Mix the solutions as shown in the table below. For each numbered mixture, tell **04-Core-21A**

(a) whether or not a reaction takes place and

(b) if there is a reaction, state the evidence for it.

MIXTURE	½ DROPPER + ½ DROPPER	
1	A	F
2	C	A
3	G	H
4	H	B
5	C	E

For each situation below: **04-Core-22A**

(a) state whether or not a reaction has occurred and

(b) if a reaction has occurred, state the evidence of the reaction.

Situation 1: Two colorless solutions are mixed. No color change is observed in the resulting solution. The test tube gets hot, no gas is released, and a white solid settles to the bottom of the beaker.

Situation 2: When clear, colorless solution X is added to colorless solution Y, the glass container in which they are mixed grows very warm, no gas is released, the solution stays clear and colorless, and no odor is observed.

Situation 3: When hydrochloric acid is added to a colorless solution, bubbles form and escape, no color change is observed, and no solid forms.

Situation 4: Two white solids both form colorless solutions when they are dissolved in water. When the two solutions are mixed, the resulting solution remains clear and colorless. No gas is given off, and the temperature doesn't change. No solid settles to the bottom.

Examine the table below which shows the data collected in three trials. **04-Core-23A**

TRIAL	MASS OF RED REACTANT	MASS OF GREEN REACTANT	MASS OF PRODUCT
1	2 g	95 g	3 g
2	2 g	125 g	3 g
3	2 g	140 g	3 g

Notice that in each trial the amount of the green reactant changes. Yet the product is exactly 3 g in each case. Explain why.

04-Core-24A If h is the symbol used for height and you were asked to measure Δh, what would you measure?

04-Core-25A A solution of lye particles and hydrochloric acid (HCl) were mixed. The HCl and the lye particles reacted. The temperature of the reacting solutions went up 5°C. How could you tell if there were still lye particles that had not reacted?

04-Core-26A Bart has three beakers labeled 1, 2, and 3, each of which contains the elements zinc (Zn) and sulfur (S). He studied a sample from the top and the bottom of each of the beakers. His data are shown in the chart below.

BEAKER NUMBER	ATOMS OF Zn	ATOMS OF S
1 (top)	100	200
1 (bottom)	100	300
2 (top)	100	75
2 (bottom)	100	60
3 (top)	100	150
3 (bottom)	100	150

1. In which, if any, of the three beakers were zinc and sulfur present as a single compound?
2. How do you know?

04-Core-27A Study the equation below.

$2AgNO_3 + CuCl_2 \rightarrow Cu(NO_3)_2 + 2AgCl$

(silver nitrate) (copper chloride) (copper nitrate) (silver chloride)

1. How many atoms of oxygen (O) are present in the reactants?
2. How many chloride atoms (Cl) are present in the products?

04-Core-28A Jack made a blue solution containing a compound composed of particles A and B. He then made a colorless solution containing a compound composed of particles C and D. When he mixed the two solutions, a green solution and a white solid were formed. What happened to the particles during the reaction to cause these changes?

04-Core-29A

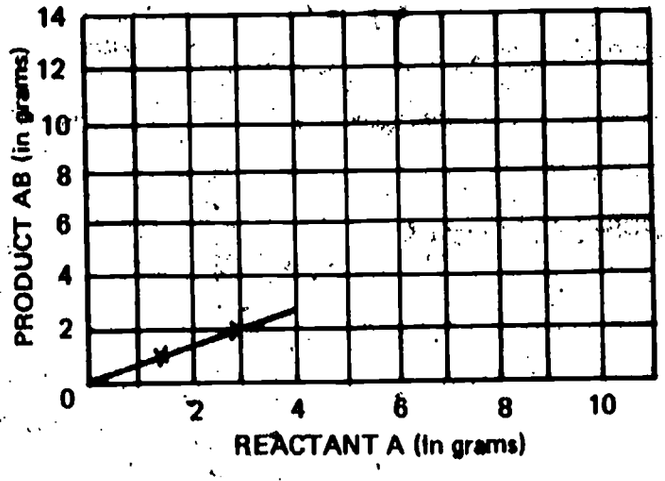
1. Is it possible for the following reaction to occur?
2. Explain your answer.

$Pb(NO_3)_2 + 2KI \rightarrow PbCl_2 + 2NaNO_3$

(lead nitrate) (potassium iodide) (lead chloride) (sodium nitrate)

04-Exc 7-1-1A Suppose that you were given the following graph and asked to predict the amount of product AB formed when 5 g and 10 g of reactant A reacted with a set amount of B.

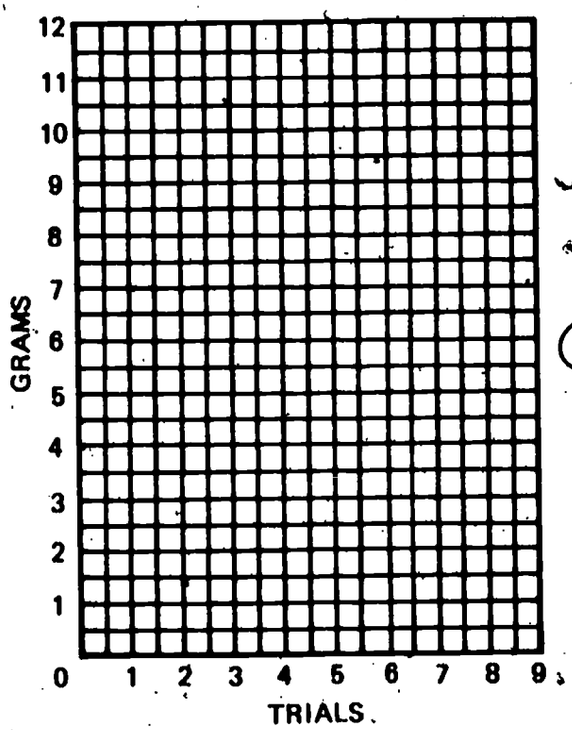
1. Which, if either, of the two predicted values would you be less sure of?
2. Why?



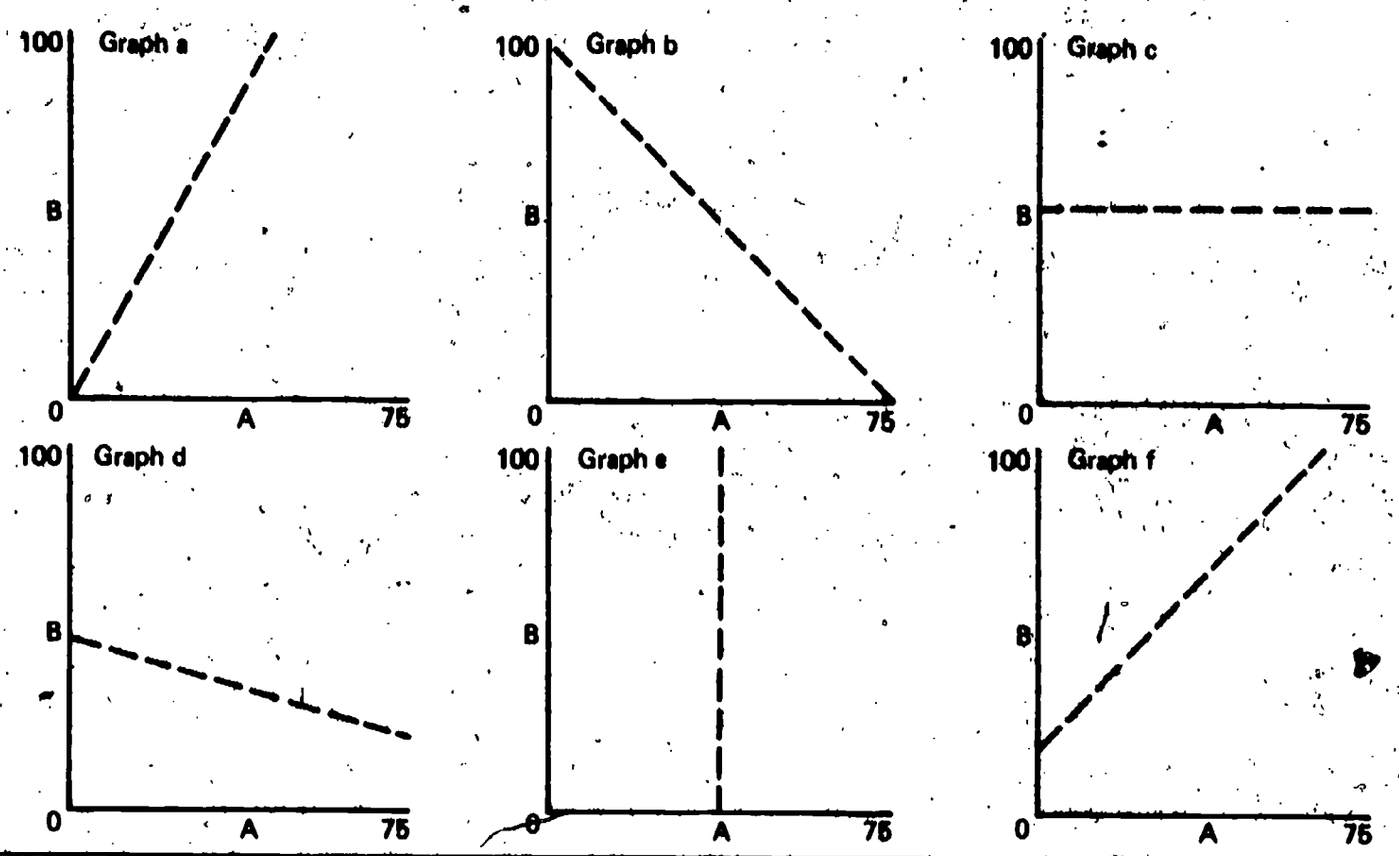
Get a piece of graph paper, label it like the grid below, and plot the data. Draw in the best-fit lines for the data.

04-Exc 7-1-2A

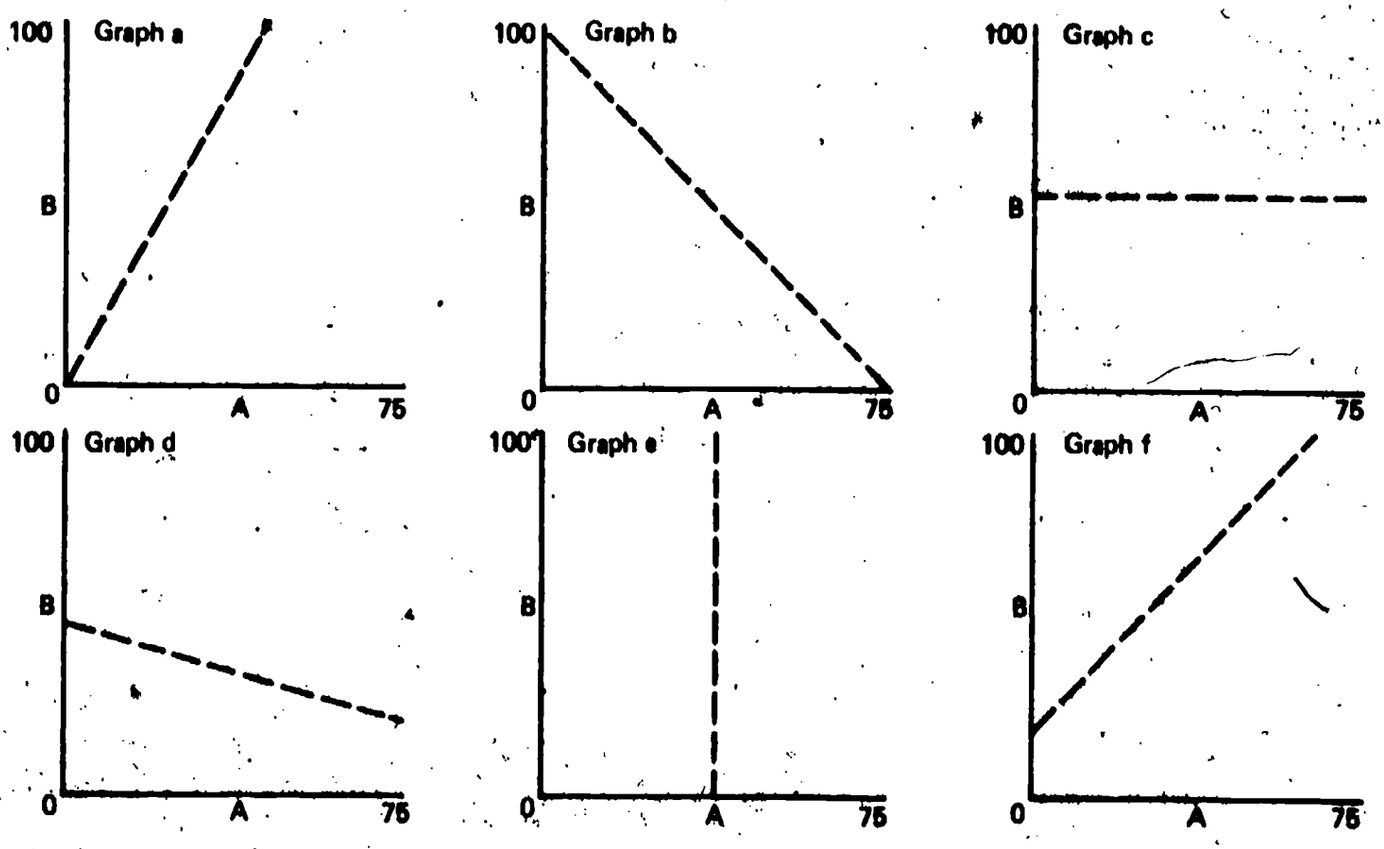
TRIAL	g OF $CaCl_3$
1	3.2
2	5.8
3	9.3
4	10.6
5	10.8
6	10.5



04-Exc 7-1-3A List the letters of any graphs which tell you that when A increases, B also increases.

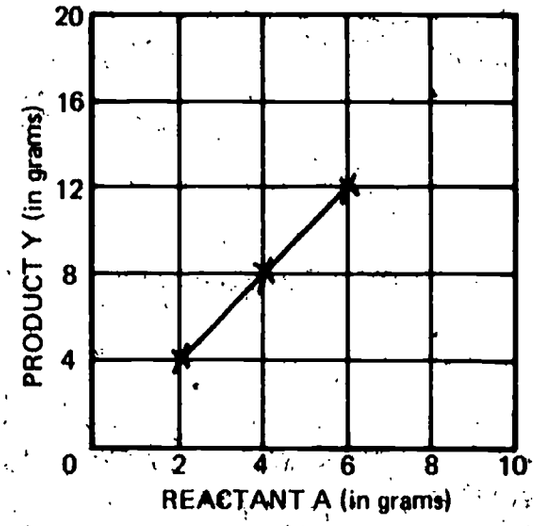


04-Exc 7-1-4A List the letters of any graphs which show one variable which stays the same while the other increases.



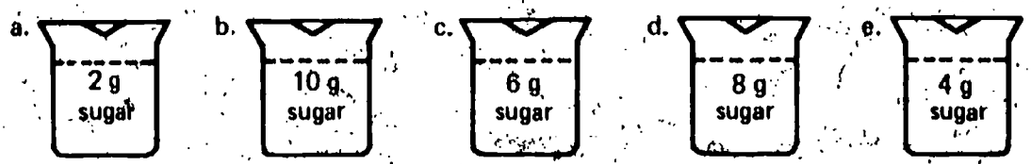
From the graph, predict how many g of product Y would be formed if **04-Exc 7-1-5A**

1. 3 g of reactant A were used.
2. 5 g of reactant A were used.
3. 7 g of reactant A were used.
4. 1 g of reactant A were used.



Jack put 100 ml of water into each of the five beakers shown below. Then in each beaker, he dissolved the different amounts of sugar shown. **04-Exc 7-2-1A**

1. Starting with the least concentrated solution, list the letters of the beakers of solutions in order of concentration.
2. Which is the more concentrated solution, b or d?



A glass of ice tea contains 100 ml of water and tea and 1.8 g of sugar. What is the concentration of the sugar in the solution? State your answer in grams per milliliter (g/ml). **04-Exc 7-2-2A**

Jim had a 500 ml bottle of maple syrup. The 500 ml of syrup contained 100 g of dissolved maple sugar. Jim poured 50 ml of the syrup on his pancakes. How many grams of maple sugar did he put on his pancakes? **04-Exc 7-2-3A**

Get the following equipment. **04-Exc 8-1-1A**

- 1 250-ml beaker
- 1 Celsius thermometer
- water

Get your teacher or an appointed observer to watch you. Measure and record the temperature of the water.

04-Exc 8-2-1A

Willie performed the following reaction by mixing two solutions:

lead nitrate + calcium chloride → lead chloride
(solution) (solution) (solid)

Lead chloride is a white solid which forms and settles to the bottom of the liquid. Willie said there should be another product, calcium nitrate.

1. If Willie is right, where is that product?
2. How could you get it?

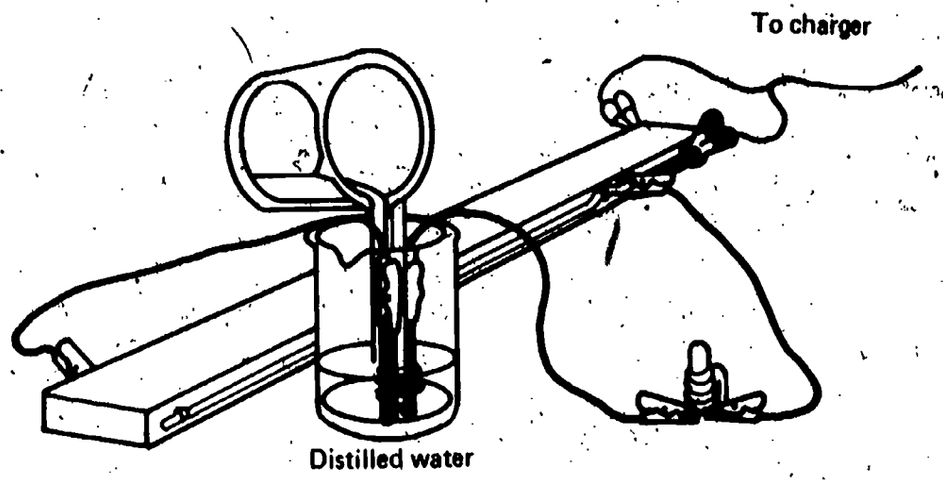
04-Exc 8-3-1A

Ammonium (NH_4) is an atom team. If ammonium hydroxide (NH_4OH) reacts with zinc chloride ($ZnCl_2$), which of the following would be a product of the reaction?

a. NH_3Cl
b. NH_2Cl
c. NCl
d. NH_4Cl
e. $NHCl$

You did the activity diagramed below to find out if copper sulfate ($CuSO_4$) in solution would conduct electricity. First you did the activity, using distilled water. Then you were asked to put $CuSO_4$ into the water. Why couldn't you have skipped the step using only distilled water and put a $CuSO_4$ solution into the beaker in the first place?

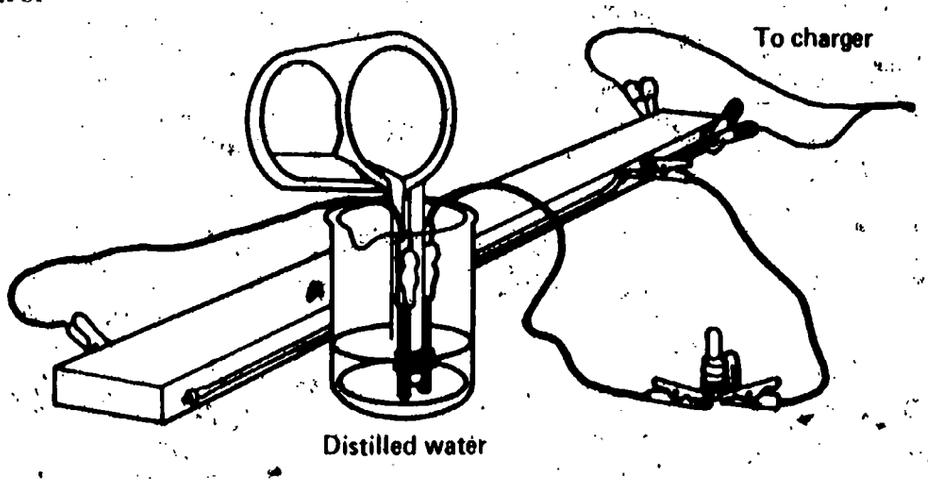
05-Core-1A



In an activity, you were asked to find out if copper sulfate ($CuSO_4$) in a solution would conduct electricity. First you tested pure distilled water, as shown below. Then you were asked to test a solution of $CuSO_4$ and water. Which term below is used to describe something that is used in the way the distilled water was used in that activity?

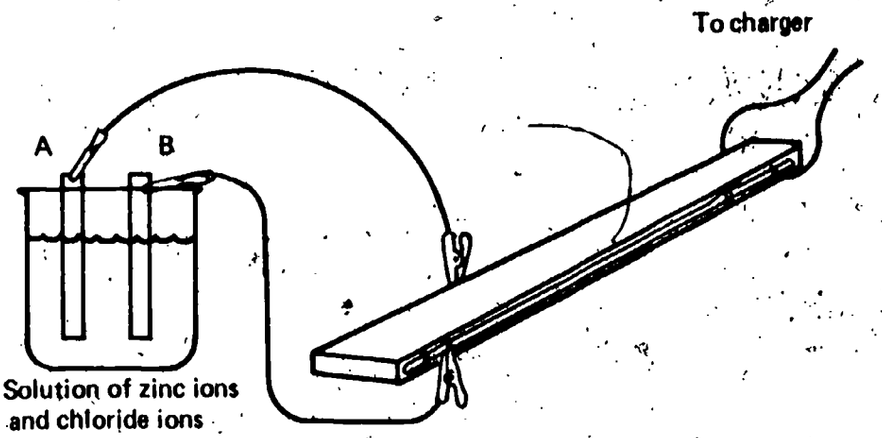
05-Core-2A

a. Reactant
b. Product
c. Element
d. Control



05-Core-3A

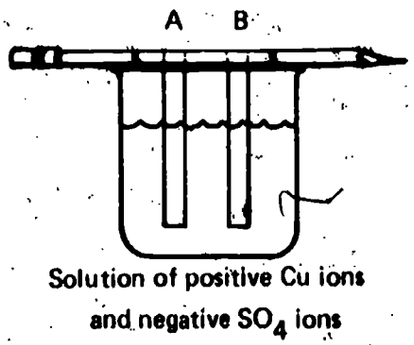
Jerry hooked up his apparatus as shown below.. Rod A was positive and attracted chloride ions. Rod B was negative and attracted zinc ions. Jerry was called out of the room, so he disconnected the rods. When he reconnected the rods, he mixed up the leads, and B became positive and A negative. How would this affect the ion flow in the solution?



05-Core-4A

Bill put two carbon rods into a copper sulfate ($CuSO_4$) solution, exactly as shown below. He wanted the copper (Cu) ions to move to carbon rod A. He left the equipment in place overnight so that the copper ions would have time to move.

1. When Bill comes to school in the morning, will the copper ions have moved to carbon rod A?
2. Explain your answer.



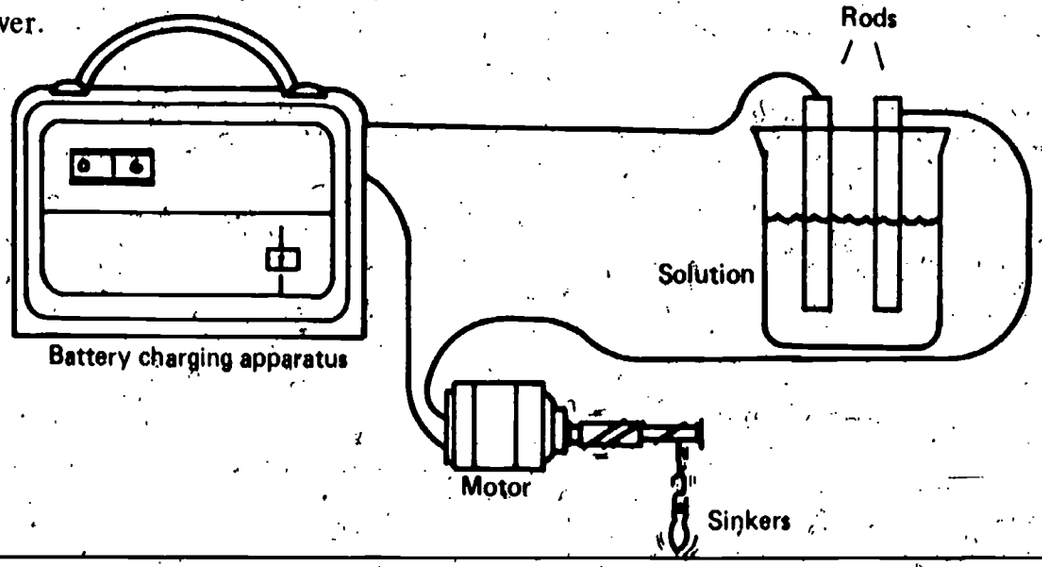
05-Core-5A

Select the phrase which best completes the following story. A Kleenex tissue is not attracted to a plastic comb. They are rubbed together. After the rubbing, the tissue is attracted to the comb. The rubbing

a. produced the same charge on both objects.
b. removed the charges so they would attract each other.
c. caused the objects to be oppositely charged.
d. either a or b.

In the diagram, the equipment is operating properly. The motor lifts the sinkers. **05-Core-6A**

1. What kind of particles does this tell you are in the solution?
2. Explain your answer.

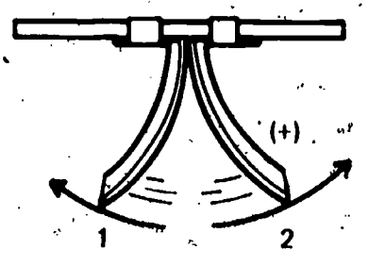


There are two types of electrical charge. What are they? **05-Core-7A**

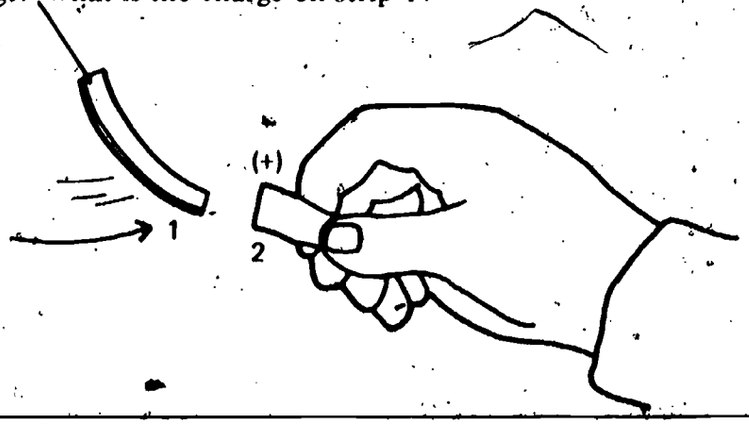
State the rule which tells what would occur when objects with like charges or objects with opposite charges are brought near each other. **05-Core-8A**

The strips of aluminum foil in the diagram below are repelling each other. Foil strip 2 has a positive charge. **05-Core-9A**

1. What is the charge on foil strip 1?
2. On what rule did you base your answer?



Rectangles 1 and 2 in the diagram are strips of aluminum foil which attract each other. Strip 2 has a positive charge. What is the charge on strip 1? **05-Core-10A**



05-Core-11A A red and a blue balloon are each given a charge. How could you find out if they have the same or different kinds of charges?

05-Core-12A Sue made a solution which contained positive iron ions.

1. If she put a positively charged rod and a negatively charged rod into the solution, would the iron ions move toward or away from the negatively charged rod?
2. Why?

05-Core-13A Get bottles 1, 2, and 3 from box 05-Core-13. Also get three test tubes. In separate test tubes, put about 3 ml of each solution. Decide what you need to do to find out if the sulfate ion is present in any of these solutions. Check your plan with your teacher. If it is all right to go on, get what you need and test the solutions. Record the bottle number of any solution which contains sulfate ions.

05-Core-14A You operationally defined the sulfate ion. What do such operational definitions of substances tell you?

05-Core-15A You have worked with negatively charged sulfate (SO_4) ions.

1. Is the SO_4 ion composed of just one element?
2. If so, what is it? If not, how many elements are there in the ion?

05-Core-16A Salt (NaCl) and potassium iodide (KI) are compounds. According to the model you are developing, what force holds the atoms in each of these compounds together?

05-Core-17A Kevin found that the ions below had the charges shown. The plus sign represents a positive charge, the minus sign a negative charge.

Ag^+, Cl^-, Br^-, Na^+, K^+, NO_3^-

Based on your experience, predict three pairs of two ions each that could combine to form compounds.

05-Core-18A

1. Select any pair or pairs of ions below in which the paired ions will attract each other.
   a. Cu^+, Na^+
   b. Cl^-, NO_3^-
   c. Na^+, NO_3^-
   d. Cl^-, Cu^+
2. State why you chose as you did.

KEY	
+	Positive ion
-	Negative ion

05-Core-19A Gary did some activities with a solid, yellow compound. He found that it contained calcium ions, which have a positive charge. He found that the only other thing the compound contained was chromate particles.

1. Name the kind of charge on the chromate particles.
2. Explain why you predicted the charge you did.

In this course you have been asked many times to label test tubes, vials, beakers, and other materials. You have also been told to write down your observations immediately. The major reason for doing these things is that **05-Core-20A**

a. students tend to forget.
b. it's a helpful procedure when investigating.
c. then you cannot make any mistakes.
d. this is science. An historian would not be so careful.

Textbooks 1 and 2 both explain what happens when electricity is passed through a copper sulfate solution. **05-Core-21A**

Book 1 says:

> A particle model for matter assumes that ions of copper are very tiny. Therefore, these matter particles could move about, and you wouldn't see them. This model is useful and may be applied to other substances as long as it is supported by your observations. To apply it to other substances, you will need more data.

Book 2 says:

> The tiny copper and sulfate ions move toward the charged rods. The movement of the copper and sulfate ions proves that differently charged ions exist in all matter and do move in solutions.

Select the answer below which correctly tells both which book a scientist would probably prefer and why he would prefer it.

a. Book 1, because it says that experimental results support models, but experimenting must continue.
b. Book 2, because it states facts that you proved in class.
c. Book 2, because it states more facts than Book 1.
d. Book 1, because it used the word *model.*
e. Either book, because they both talk about the same thing.

Assume that Dr. Lillian Braithwaite is a great scientist who is respected and listened to by other scientists. She says that virus X causes brain damage in mice. Other scientists would accept the statement if Dr. Braithwaite **05-Core-22A**

a. put a statement about this into a textbook she is writing.
b. got three other great scientists to agree to say that they believe she is correct.
c. produced a pure strain of virus X.
d. reported her experiments involving both some mice infected with virus X and some which were not.

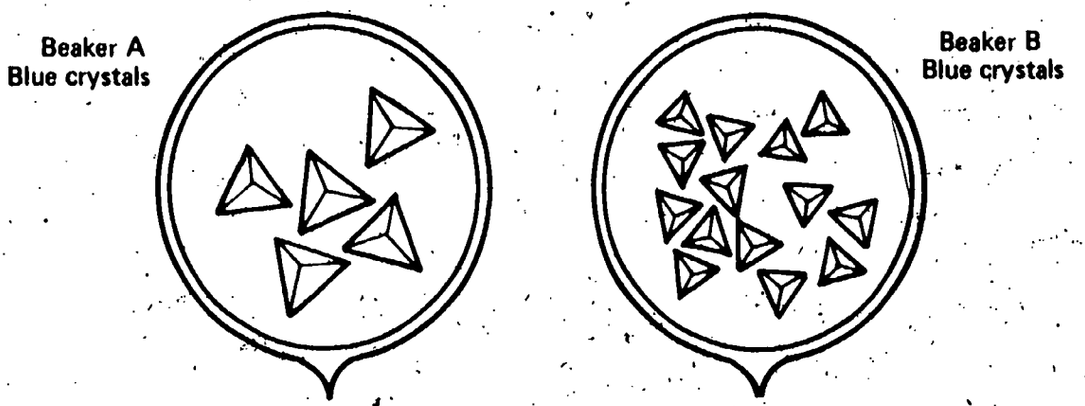
In Chapter 10, you studied the behavior of some matter particles in solutions. The text discussed a kind of matter particle called an *ion.* Which of the following statements best describes ions? **05-Core-23A**

a. Scientists have seen ions in solutions.
b. All matter is made up of ions.
c. Only the ion model can explain the observations you made.
d. The idea of an ion was thought up by scientists to explain the behavior of some matter particles.

05-Exc 9-1-1A Suppose you fell into a solution and shrank. If you shrank to the size of matter particles, you could ride Iggy's Ion Express. If you want to ride to the town of Positive Rod, what would you be charged?

05-Exc 10-1-1A Bill left beakers A and B of the same solution sitting in different places in Mr. Taylor's room. Later, Jane found the beakers. The solutions had evaporated, leaving crystals which looked like those in the diagrams below.

1. Which of the solutions had evaporated faster?
2. Explain your answer.



05-Exc 10-2-1A Open your textbook to Table 1 on page 472.

Steve filled in the table with the following data, working with a setup like the one shown on page 473, but using silver metal strips and silver nitrate solution.

	NEGATIVE STRIP	POSITIVE STRIP
Initial pointer position	5.3 cm	5.3 cm
Final pointer position	6.7 cm	4.1 cm
Change in position	down 1.4 cm	up 0.8 cm
Observations	silver crystals forming	

On your answer sheet, tell how you explain the data above. Use a labeled diagram to illustrate your answer.

In Chapter 11 you put some sodium chloride solution into a beaker. You then tested it to see if it conducted electricity. When you finished, you put the solution into the "used" jar. Why didn't you just put the solution back into the jar it came from, since you didn't add any other chemicals to it? **06-Core-1A**

Mike had a solution which contained particles of an element. He put a positively and a negatively charged rod into the solution. The particles of the element were not attracted to either of the rods. Which of the following kinds of particles of the element are in the solution? **06-Core-2A**

a. Atoms
b. Ions
c. Either a or b
d. None of the above

Larry put two carbon rods, which were connected to a battery charger, into a solution of nickel nitrate. The nickel ions moved toward the rod with the negative charge. What was the charge on the nickel ions? **06-Core-3A**

Jack wiped his uncharged shoe on an uncharged wool rug. His shoe and the rug became charged. Explain what happens to cause the two neutral objects to become charged by being rubbed together. **06-Core-4A**

Jan charged a rubber rod by rubbing it with a piece of tissue paper. She then brought the rubber rod close to the tissue paper. **06-Core-5A**

1. Will the rod and the paper attract or repel each other?
2. Why?

Write the letter of the best answer in each of the following cases. **06-Core-6A**

Case 1. If a plastic comb has a positive charge, it has
a. as many negative as positive charges.
b. fewer positive charges than negative charges.
c. fewer negative charges than positive charges.
d. just positive charges.

Case 2. If a rubber comb has a negative charge, it has
a. fewer negative charges than positive charges.
b. more negative charges than positive charges.
c. just negative charges.
d. as many positive charges as negative charges.

Jack noticed that when he rubbed a neutral rubber rod and a neutral piece of rabbit's fur together, they became oppositely charged. Explain how opposite charges were produced by rubbing two objects together which had been neutrally charged. **06-Core-7A**

06-Core-8A Record the letter of the phrase below which correctly completes the sentence. A neutral object has

a. no positive or negative charges.
b. fewer negative than positive charges.
c. more negative than positive charges.
d. equal numbers of positive and negative charges.

06-Core-9A Donna hung a Ping-Pong ball from a piece of string. She found that two rods, one a positively charged rubber rod and the other a negatively charged glass rod, attracted the ball. What was the charge on the ball?

06-Core-10A Jim had two Ping-Pong balls. He knew that ball A was neutrally charged and ball B had a negative charge. When he found that balls A and B attracted each other, he allowed them to touch. After a few seconds, the balls began to repel each other and continued to repel. Explain why they first attracted and then repelled each other.

06-Core-11A Give an operational definition for *neutrally charged particle of a powder.*

06-Core-12A Suppose you were given a pink solid and asked to determine if the solid was made of ions, of one kind of atom, or of one kind of molecule. Select any of the following which you would need to know to identify the kind of particles in the solid.

a. The amount of the solid which will dissolve in water
b. The size and shape of the solid
c. If a solution of the solid will conduct electricity
d. If its powder is attracted to a negatively charged vinyl strip
e. If the solid can be broken down into two or more simpler substances

06-Core-13A Dr. Lee found a procedure for breaking down large starch molecules into smaller units. Which of the following is a possible product of such a breakdown?

a. Smaller molecules
b. Atoms
c. Elements
d. Other compounds (combinations of different atoms)
e. All of these

06-Core-14A Bob found that baking soda, a powder, is attracted to both a positively charged acetate strip and a negatively charged vinyl strip. He therefore concluded that baking powder must be made up of molecules, not ions.

1. Do you agree or disagree?
2. Explain your answer.

06-Core-15A Two atoms of hydrogen and an atom of oxygen combine to form one molecule of water. It requires a great deal of force to separate the neutral atoms once they have combined.

1. What force holds the neutral molecule together?
2. Explain how this force can exist in a neutral molecule.

Salt is a substance which is made up of atoms of chlorine and atoms of sodium combined in definite numbers. What are such substances called? **06-Core-16A**

Neutral atoms of chlorine gain negative charges from atoms of sodium and become chlorine particles with a charge. What name do scientists give to such atoms with a charge? **06-Core-17A**

Cornstarch is made up of molecules. Record the letter of any of the following which are true statements about cornstarch. **06-Core-18A**

a. The substance contains no positive or negative charges.
b. A solution of the substance will conduct electricity.
c. The substance contains both positive and negative charges.
d. The substance is attracted to a positively charged acetate strip.
e. The substance is attracted to a negatively charged vinyl strip.

Select the statement below which is part of the atomic model. **06-Core-19A**

a. Matter contains no positive or negative charges.
b. There are billions of different kinds of matter atoms.
c. Matter contains movable negative charges.
d. There are no particles in gases.

Read the following carefully. The particle model that you have developed is incomplete, but you have been working on it for less than a year. You are working toward the same completed model which scientists have already finished developing. **06-Core-20A**

1. Do you agree or disagree with the statement above?
2. Why?

Suppose that all scientists accepted a particle model for sound. This would mean that **06-Core-21A**

a. scientists had direct proof that sound exists as particles.
b. at least a few good scientists had actually seen sound particles with their own eyes.
c. thinking about sound as though it were made of tiny particles explained most of the observations made up to that time.
d. sound is exactly like matter particles.
e. no other model could explain the observations made up to that time.

Select the phrase which completes the sentence correctly. The atom, a particle of an element, is a model now being used to explain matter. Scientists accepted the atomic model **06-Core-22A**

a. when no other model could describe the reactions of matter.
b. when thinking about matter as tiny particles proved to be useful.
c. when Congress passed a law that gravity can exist only if it is in the tiny particles described by the model.
d. only when gravitons were seen in experiments.

06-Core-23A If you are thinking about the concept of electrical charge, which of the following terms does not belong with the other three?

a. Atoms
b. Molecules
c. Neutral particles
d. Ions

06-Core-24A On your answer sheet, beside the number of each statement, write the word *atom* for statements that are true of atoms. Write the word *ion* for the statements that are true of ions. Write the word *both* for statements that are true of both atoms and ions.

1. They are present in a piece of copper.
2. They can be colored.
3. They have an equal number of positive and negative charges.
4. They contain positive and negative charges.
5. They can be particles with more positive charges than negative.

06-Core-25A When John tested three substances, he found that their solutions conducted electricity. When the substances were dry and powdered, they were attracted both to positively and to negatively charged acetate strips. Look at the chart of his data below.

SUBSTANCE	CONDUCTS ELECTRICITY	ATTRACTED TO POSITIVE CHARGE	ATTRACTED TO NEGATIVE CHARGE
Blue	yes	yes	yes
Brown	yes	yes	yes
Purple	yes	yes	yes

Based on these data, what can you conclude about the substances? Select the statement below which correctly describes the substances.

a. They are ionic, and each substance contains unequal amounts of positive and negative charges.
b. They are molecular, and each substance contains unequal amounts of positive and negative charges.
c. They are molecular, and each substance contains equal amounts of positive and negative charges.
d. They are ionic, and each substance contains equal amounts of positive and negative charges.

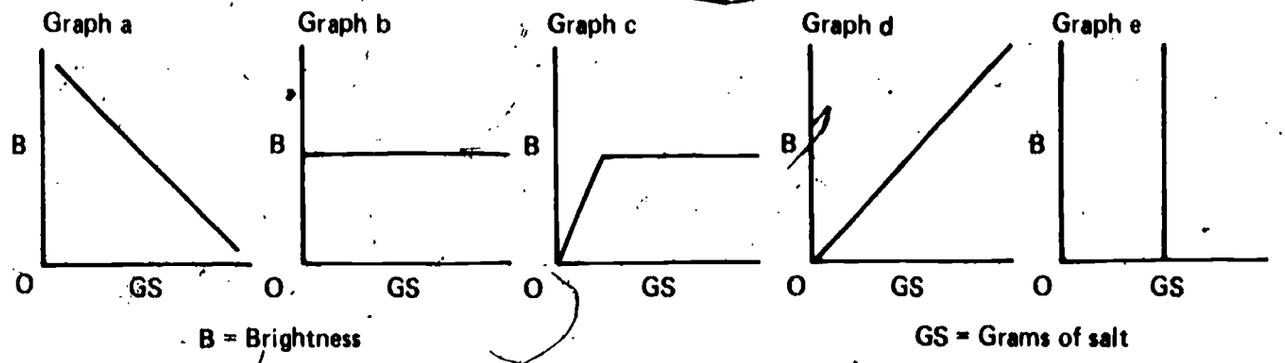
06-Exc 11-1-1A For many years, people thought that water was an element.

1. Is it?
2. Explain your answer.

Leroy used a shortcut in doing the excursion "Strip Affects Drip." Instead of using one vinyl and one acetate strip, he used only an acetate strip. He gave it a positive charge and held it near a stream of drips. The drips were attracted to the charged strip. Leroy concluded that the drips were neutral. **06-Exc 11-2-1A**

1. Was this a good conclusion?
2. Explain your answer.

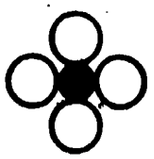
You may look at your book and notes for this question. If in Excursion 11-3, "Electrolytes Light," you were to draw a graph of your data, which of the following graphs best represents the general shape you would find? **06-Exc 11-3-1A**



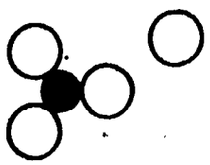
Suppose you had one nitrogen atom and four chlorine atoms. If nitrogen atoms have a combining power of 3 and chlorine atoms have a combining power of 1, which of the following diagrams shows the most likely combination of these five atoms? **06-Exc 12-1-1A**

a.

b.



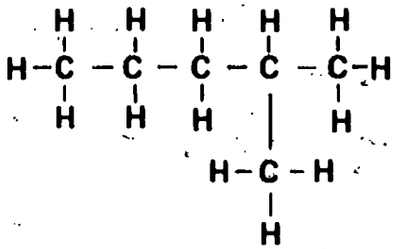
c.



d.

Key	
Nitrogen atom	●
Chlorine atom	○

06-Exc 12-1-2A Draw a structural formula for an isomer of the 6-carbon molecule shown below.



06-Exc 12-1-3A Both Chris and Stephanie have white powders. Each girl claims that the chemical formula for her powder is $C_4H_4O_4$. Test results for the powders are below.

	CHRIS'S POWDER	STEPHANIE'S POWDER
Melting point °C	83	139
Soluble in water	slightly	very

They repeat their tests several times to check their results.

1. Is it possible that both compounds really have the same formula?
2. Explain your answer.

Define the term *reaction rate* as it is used in the following sentence. The reaction rate between mixed hydrogen and oxygen is amazing. **07-Core-1A**

Hal wants to state the concentration of a sugar solution. Select any of the following things he must know. **07-Core-2A**

a. The brand name of the sugar dissolved
b. The speed with which the solution formed
c. The color of the solution
d. The mass of the sugar dissolved
e. The volume of the solution

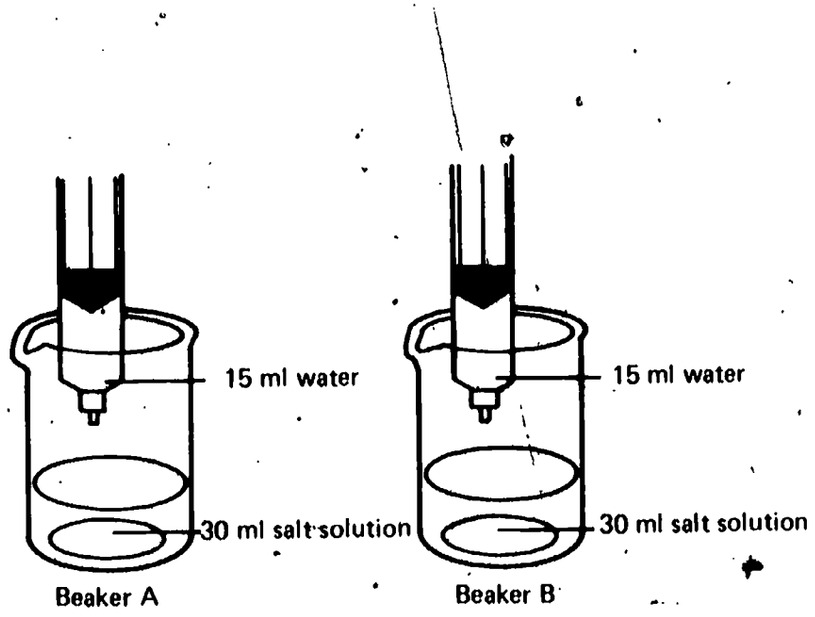
Write a definition for *concentration* as it is used in the following sentence. The concentration of the instant lemonade drink solution is so great that it tastes bitter. **07-Core-3A**

Barry mixed two solutions and made the following observations. Which of his observations are ways of stating the rate of a reaction? **07-Core-4A**

a. One of the reactants was used up in 5 seconds.
b. The total volume of the reaction was 28 ml.
c. In 3 seconds, 20 grams of a yellow solid formed.
d. The mixed solutions turned blue in 0.5 seconds.
e. Three cc of the product weighed 5 grams.

Jane pours 30 ml of a salt solution into beaker A and 30 ml of the same solution into beaker B. She then adds 15 ml of water to each beaker. **07-Core-5A**

1. How do the concentrations of the solutions in beakers A and B compare with each other?
2. Explain your answer.



07-Core-6A

BEAKER	VOLUME OF KI SAMPLE (in ml)	VOLUME OF WATER ADDED (in ml)	TOTAL VOLUME OF FINAL SOLUTION (in ml)
A	100	0	100
B	40	60	100
C	70	30	100
D	10	90	100
E	80	20	100

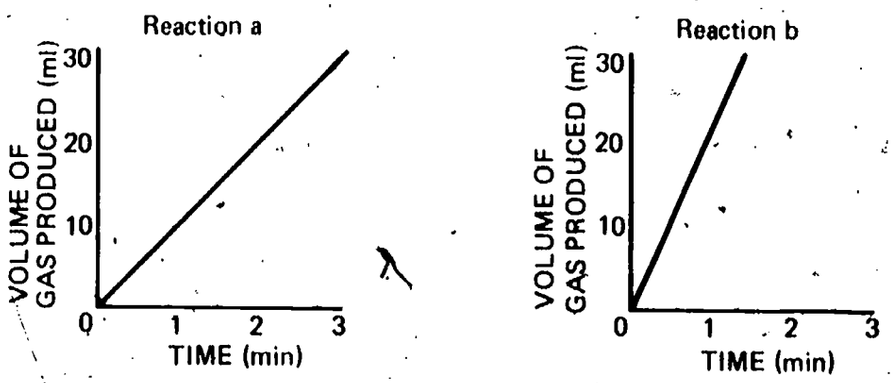
All the potassium iodide (KI) samples were taken from the same bottle and diluted with the volume of water recorded in the table above. Place the numbers 1 through 5 on your paper. Using the concentrations listed below and the beaker letters from the table, match each final solution described in the table with the proper statement of its concentration.

1. Most concentrated
2. Second most concentrated
3. Third most concentrated
4. Fourth most concentrated
5. Least concentrated

07-Core-7A

The graphs below show the results of two reactions of the same chemical system. The reactants in the system are hydrochloric acid (HCl) and a colorless solution. One of the products is a gas. A different amount of HCl is used in each reaction, but the amount of the colorless solution is the same in both reactions.

1. In which reaction is the greater amount of HCl used?
2. How do you know?



07-Core-8A

Reaction A: 10 ml HCl + 20 ml water + 1 g zinc → hydrogen
Reaction B: 10 ml HCl + 10 ml water + 1 g zinc → hydrogen

1. Would both of the reactions above have the same reaction rate?
2. If so, explain why. If not, name the variable that accounts for the difference.

Reaction A: 10 ml HCl + 15 ml water + 1 g iron powder → hydrogen

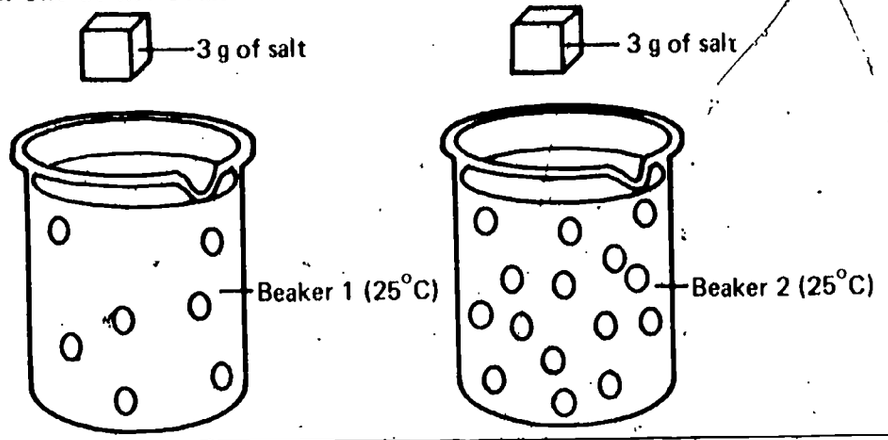
Reaction B: 5 ml HCl + 20 ml water + 1 g iron powder → hydrogen

1. Would both reactions above have the same reaction rate?
2. Explain the two reasons for your answer in terms of particle collisions.

07-Core-9A

Both beakers below show dissolved particles of substance O. Blocks of salt with masses of 3 g are put into each of the beakers, 1 and 2, and reactions of O + salt occur. In terms of particles, how would your model explain that the reaction rate will be faster in one of the beakers than in the other?

07-Core-10A



07-Core-11A

STATE	PARTICLE SPEED
Solid	slowest
Liquid	medium
Gas	fastest

The table above is based on your particle model.

1. On the basis of its information, which of the reactions below would have the fastest reaction rate? (S stands for sulfur and O for oxygen.)

   a. $S\ (solid) + O_2\ (gas) \rightarrow SO_2\ (gas)$

   b. $S\ (liquid) + O_2\ (gas) \rightarrow SO_2\ (gas)$

   c. $S\ (gas) + O_2\ (gas) \rightarrow SO_2\ (gas)$

2. Explain your answer in terms of the particle model.

07-Core-12A

In Chapter 14, you heated some HCl. On your paper, list the numbers of the variables listed below. Based on your particle model and your experience, indicate how that variable responds to heating by writing *increases*, *decreases*, or *remains the same* after the number of each variable.

1. Volume
2. Number of particles
3. Kinetic energy of particles
4. Particle size
5. Rate of particle collision
6. Particle speed

07-Core-13A

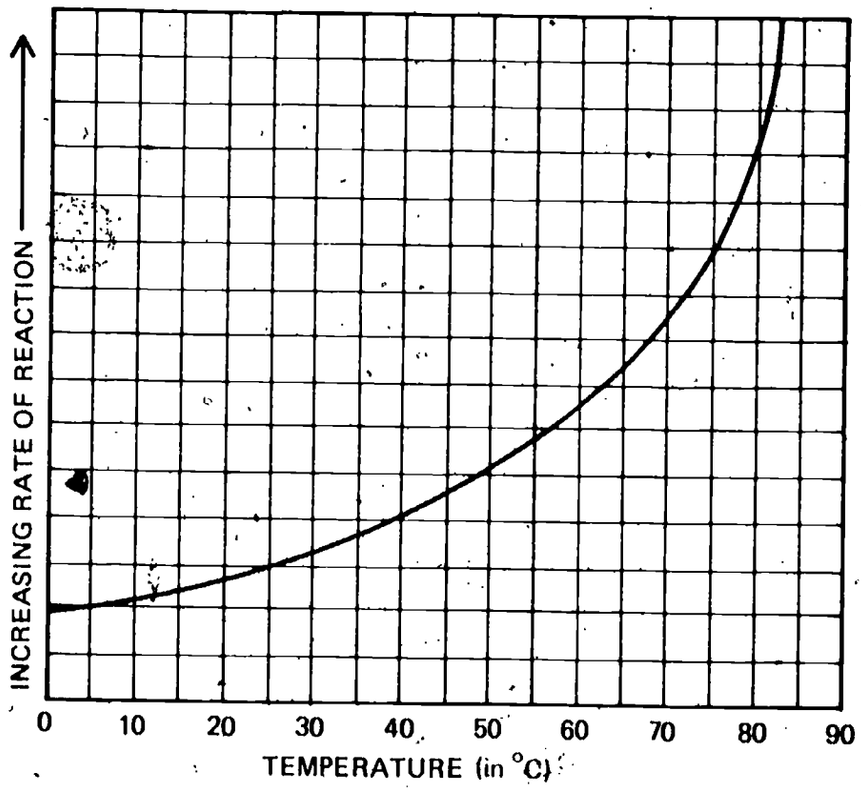
Norman poured two samples of 30 ml of hydrochloric acid (HCl) into two jars. The samples had the same concentrations, but one of the samples was at 20°C and the other was at 35°C. He added 1 g of zinc to each HCl sample. The warmer sample reacted faster. Use your model to explain how temperature differences cause the rates of two reactions to be different.

07-Core-14A

TRIAL	TEMPERATURE	REACTANTS	RATE
1	?	100 ml milk + 1 ml lemon juice	soured quickly
2	10°C	100 ml milk + 1 ml lemon juice	soured slowly

1. What can you tell about the temperature of trial 1 as compared to that of trial 2?
2. How can you tell?

07-Core-15A



According to the graph above, which of the following temperature intervals produces the greatest change in reaction rate? Select the letter of the correct answer.

a. 0° to 20°C
b. 20° to 40°C
c. 40° to 60°C
d. 60° to 80°C

Sam collected the data shown in the table below. **07-Core-16A**

TRIAL	CONCENTRATION	TEMPERATURE	CATALYST
A	10 ml $KMnO_4$ + 5 ml $H_2C_2O_4$ + 5 ml water	35°C	none
B	10 ml $KMnO_4$ + 5 ml $H_2C_2O_4$ + 8 ml water	40°C	none

Trials A and B have the same reaction rates.

1. Are the collision rates the same in A and B?
2. How would your particle model explain your answer?

Write an operational definition of the word *catalyst* which includes all the characteristics of a catalyst. **07-Core-17A**

1. Consider the two trials of the reaction below. **07-Core-18A**

Trial A.

A 20 g sample of zinc nitrate is heated. The reaction produces 15 ml of oxygen in one minute.

Trial B.

A 20 g sample of zinc nitrate is heated with a little copper nitrate (blue-green). The reaction produces 15.5 ml of oxygen in one minute, and the blue-green crystals turn black.

Does copper nitrate act as a catalyst for the reaction?

2. Consider the two trials of the reaction below.

Trial A.

A 10 g sample of hydrogen peroxide (H_2O_2) is heated gently. The reaction gives off 1 ml of oxygen in 30 seconds.

Trial B.

A 10 g sample of H_2O_2 is heated with a little gold dust. This gives off 40 ml of oxygen in 30 seconds. The gold dust is unchanged.

Does gold dust act as a catalyst for the reaction?

3. Consider the two trials of the reaction below.

Trial A.

A 20 ml sample of vinegar and 4 g of baking soda react to produce 25 ml of gas in 30 seconds.

Trial B.

A little ammonium hydroxide is added to the 20 ml of vinegar and 4 g of baking soda. The ammonium hydroxide is used up, and 10 ml of gas is produced in 30 seconds.

Does ammonium hydroxide act as a catalyst for the reaction?

Sue wanted to know if a copper BB is a catalyst for the hydrochloric acid-shell reaction. Design a method to find out. The rate of the reaction is indicated by the rate at which carbon dioxide gas is produced. Include statements of (1) which variables should be kept constant (HINT: What things cause the reaction rate to change?) and (2) which variables should vary. Also (3) include a test to show if the BB reacts or cause the reaction. **07-Core-19A**

07-Core-20A

Frank heard that manganous sulfate ($MnSO_4$) was a catalyst for the reaction between hydrochloric acid (HCl) and shell. To three test tubes in which HCl and shell were reacting, he added ¼ teaspoon of $MnSO_4$ to one, ½ teaspoon to the second, and 1 teaspoon to the third. The reaction rate did not change in any of the three test tubes. In further trials he plans to add 2 and 3 teaspoons of $MnSO_4$ to two other test tubes of HCl-shell.

1. Are these additional trials necessary to find out if $MnSO_4$ is a catalyst for the reaction?
2. Explain your answer.

07-Core-21A

Three students had been studying the reaction of burning sulfur dioxide to form sulfur trioxide.

$2SO_2 + O_2 \rightarrow 2SO_3$

Al Green said, "I've found that platinum is a catalyst for the reaction."
Bill Brown said, "I've found that vanadium pentoxide is a catalyst for the reaction."
Gina White said, "I've found that ferric oxide is a catalyst for the reaction."

1. How many of these students could be correct?
2. Why?

07-Core-22A

The rate of a reaction like the one below often changes with a change in temperature, with a change in concentration, or when a catalyst is used.

HCl + egg shells → CO_2

The carbon dioxide (CO_2) gas can be collected in test tubes by water displacement. Describe a procedure you could follow which would show if changing the concentration of the HCl would change the reaction rate. In your procedure include what things should be varied and what should be kept constant. (HINT: What variables affect reaction rates?)

07-Core-23A

Casey heated potassium chlorate ($KClO_3$) and a little manganese dioxide (MnO_2). Oxygen was given off faster than when $KClO_3$ was heated without the MnO_2. Casey concluded that since MnO_2 is a catalyst for the $KClO_3$ reaction, it must be a catalyst for the reaction between HCl and shell.

1. Do you agree?
2. Explain your answer.

07-Core-24A

Select the two variables which affect the rate of a chemical reaction.

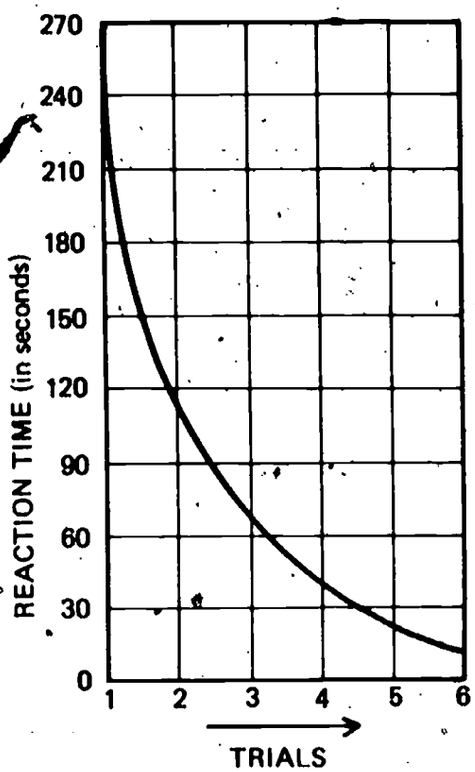
a. The concentration of reactants
b. The color of the reactants
c. The temperature of the reactants
d. The student who does the reaction
e. The shape of the container used for the reactants

07-Core-25A

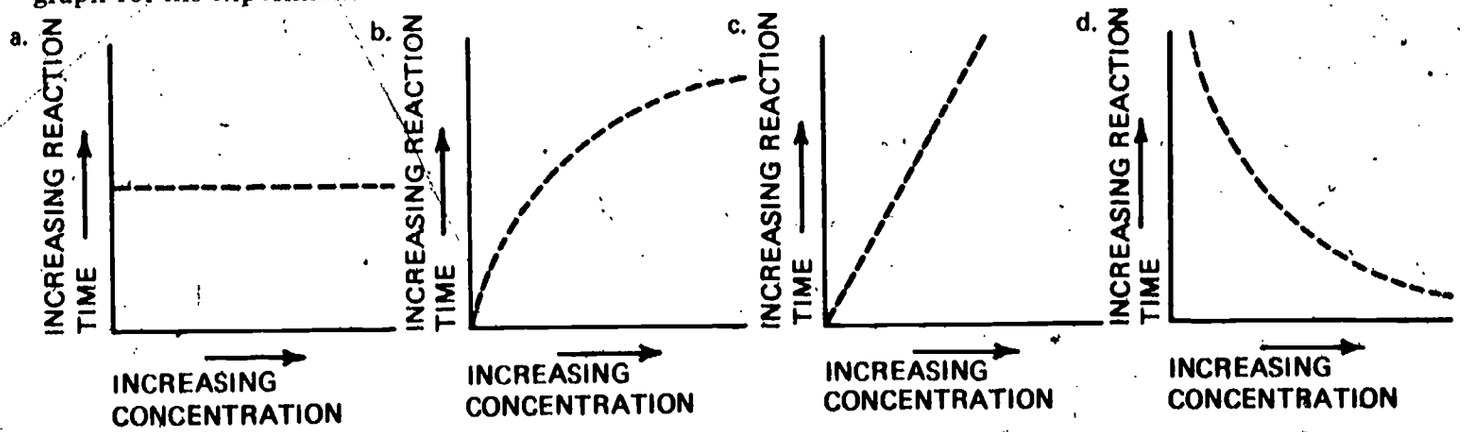
From each set of parentheses select the choice which makes the statement true. A reaction will probably go fastest if the concentration of the reactants is (high, medium, low), if the temperature is (high, medium, low), and if a catalyst is (present, absent).

Study the graph. 07-Exc 13-1-1A

1. In which trial is there the greatest number of collisions between particles of reactants per second?
2. Explain your answer in terms of concentration and reaction time.



Bill studied the effect of changes in the concentration of HCl on the reaction time of the reaction zinc + HCl → hydrogen. He defined *reaction time* as the time needed to produce 20 ml of hydrogen gas. Which of the graphs below is probably the correct graph for his experiment? 07-Exc 13-1-2A



07-Exc 13-2-1A	Consider the two cases below. Case 1. Flour in a sack won't burn very well, even when heated with a torch. Case 2. Flour dust in the air in a flour mill reacts so quickly at room temperature that a small spark can cause it to explode violently. How can you explain the difference in reaction rates between Case 1 and Case 2?
07-Exc 14-1-1A	In Excursion 14-1, you saw that reactions involving air take place more slowly in cold air than in warm air. How would the particle model explain this in terms of particle speed and collisions?
07-Exc 15-1-1A	Vegetables are put into boiling water for 3 to 5 minutes before they are frozen. This nearly stops the reactions that otherwise cause spoiling even when the vegetables are frozen. Explain what heating does that stops the chemical reaction in the vegetables (living things).
07-Exc 15-1-2A	Temperatures well above 80°C are needed for the juices from a hamburger to react with oxygen to produce carbon dioxide and water rapidly enough to produce noticeable heat. Yet the same reaction – hamburger juices plus oxygen – produces carbon dioxide and water and noticeable amounts of heat at 37°C in your body. Why?

The sodium hydroxide (NaOH) solution you used in Chapter 16 to release ammonia (NH_3) from egg whites and fertilizers was not very concentrated. What effect would the use of a much stronger concentration of NaOH have on the reaction? **08-Core-1A**

In Activity 16-11 when you added sodium hydroxide (NaOH) to the meat, egg white, and other substances, ammonia (NH_3) would have been given off and bubbled through the Nessler's solution even if you had not heated the mixture. Why, then, did you heat it? **08-Core-2A**

Before you begin, tell your teacher that you are going to do this check. **08-Core-3A**

Is there any change in the odor of phenolphthalein when sodium hydroxide (NaOH) is added to it? To answer this, do the following.

1. Put 6 drops of phenolphthalein into a test tube.
2. Smell it.
3. Add 2 drops of NaOH.
4. Smell the mixture.

Are the smells noted in steps 2 and 4 the same or different?

In Activity 16-11, you found that uncooked meat, potato, urine, and soy sauce contained NH_3. If you had tested further, you would have found that they contained carbon and oxygen, as well as nitrogen and hydrogen. How do you explain that these substances contain the same elements and yet are so different? **08-Core-4A**

Bob tested five substances for ammonia, sulfate, and copper. His results are shown in the table below. Write the colors of any substances which you know contain nitrogen. **08-Core-5A**

SUBSTANCE TESTED	AMMONIA PRESENT	SULFATE PRESENT	COPPER PRESENT
Blue	no	no	no
Orange	yes	yes	no
Purple	yes	no	no
Red	no	yes	yes
Black	no	yes	no

Otis tested a white solid ($NaNO_3$) and a yellow liquid (HNO_3) by putting each into a different flask with 10 ml of sodium hydroxide (NaOH) and then heating the two flasks. He bubbled the gases given off through 5 ml of Nessler's solution. No color change was observed in the Nessler's solution for gases from either of the substances. Otis concluded that the substances did not contain nitrogen. **08-Core-6A**

1. Do you agree or disagree with this conclusion?
2. Explain your answer.

08-Core-7A

Before you begin, tell your teacher that you are going to do this check.

Get bottle A from box 08-Core-7. Then, using as much of the substance in the bottle as you can get on the end of a wooden splint, test the substance for the presence of ammonia. Open your textbook and follow the Nessler's test procedure outlined on pages 233 through 235. Report your results and conclusions.

08-Core-8A

Tell your teacher that you are going to do this check before you start it.

Is there any change in the odor of phenolphthalein when sodium hydroxide (NaOH) is added to it? To answer this, do the following.

1. Put 6 drops of phenolphthalein into a test tube.
2. Smell it.
3. Add 2 drops of NaOH.
4. Smell the mixture.

Are the smells noted in steps 2 and 4 the same or different?

08-Core-9A

Earlier in this course you discovered that the millions of substances in our world are made up of 100 or so elements. Now, in Chapter 16, you as a scientist tested this concept again by testing many things to see if they contain nitrogen. Why do scientists keep testing accepted concepts?

08-Core-10A

You have used Congo red indicator to tell when an antacid reactant is used up. How do indicators work? Why do they change color when they do?

08-Core-11A

Karen measured the volume of sodium hydroxide (NaOH) needed to react with 1, 2, 4, 5, and 6 ml samples of vinegar, using phenolphthalein as the indicator. She then graphed the data and predicted how much NaOH would be needed to react with 8 ml of vinegar. Explain why Karen could make such a prediction.

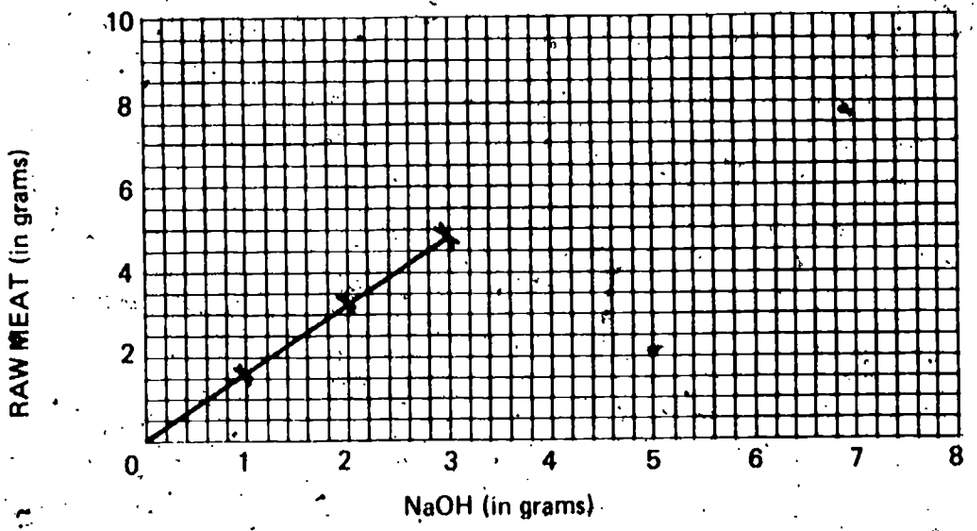
08-Core-12A

In Activity 17-3, you added sodium hydroxide (NaOH) to five different volumes of citric acid. Then you filled in the chart below. For each volume of citric acid used, you added NaOH until the phenolphthalein changed color. You repeated the process, using the same volume of citric acid. Then you averaged trials 1 and 2. Explain why doing the process twice and finding an average is better than doing it once.

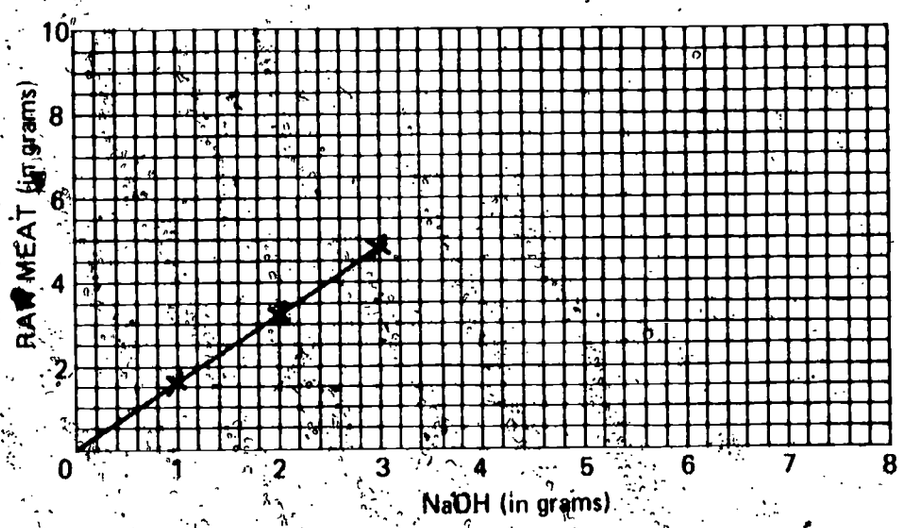
	VOLUME OF CITRIC ACID USED	ACTUAL VOLUME OF NaOH USED	PREDICTED VOLUME OF NaOH
Trial 1	4 ml		
Trial 2	4 ml		
Average	4 ml		

Kevin ran three trials of the reaction between raw meat and NaOH. He then drew the graph shown below. How many grams of meat will react with 5 g of NaOH?

08-Core-13A



08-Core-14A



John ran three trials of the reaction between raw meat and NaOH. His data are plotted on the grid above.

1. How many grams of meat will react with 5 g of NaOH?
2. The reason you can answer question 1 is that:
   a. meat particles have special reactions.
   b. reactants always combine in definite numbers.
   c. you have worked with NaOH and meat before.
   d. the relationship between meat and NaOH changes only if more than 10 g of NaOH is used.

08-Core-15A

You are to find out how much vinegar (acid) can be neutralized by 1 g of the powder in bottle 08-Core-15A. To do this, use the following procedure.

1. Dissolve 1 g of the powder in 15 ml of H_2O.
2. Add 2 drops of Congo red.
3. Add acid in small quantities until you see a permanent color change.
4. Find the amount of acid neutralized.
5. Make a second trial, repeating steps 1, 2, 3, and 4, and then average the amount of acid in the two trials.

08-Exc 16-1-1A

John used 250 g (150 cc) of modeling clay to model a car. Then he added 50 g (30 cc) more. Notice that he increased the mass (g) and the volume (cc).

1. What does this do to the density of the clay?
2. Explain your answer.

08-Exc 16-1-2A

Get 90 ml of the solution in bottle 08-Exc 16-1-2A. Find the density of the solution. Return the used solution to your teacher.

08-Exc 16-1-3A

Dennis had a beaker full of mercury, whose density is 13.6 g/cc. He also had the four things shown in the table below. After the number of each thing, indicate whether or not it would float or sink in mercury.

MATERIAL	g/cc DENSITY
1. Penny	8.9
2. Tungsten wire	19.4
3. Gold	19.0
4. Iron ball	7.9

08-Exc 17-1-1A

In Activities 17-5 and 17-6, Dale measured 1 gram of crushed antacid A on a balance. He put this amount into 10 ml of water and added 5 drops of Congo red. Then, as his partner stirred, he added the acid to the antacid A solution in 1- or 2-ml squirts. It changed to blue when all of antacid A was used up.

1. If Dale used 20 ml of water in Activity 17-5, would this affect the amount of stomach acid that was neutralized?
2. Explain your answer.

08-Exc 17-2-1A

Jack added vinegar to a solution of baking soda, and the reaction bubbled furiously. Then, suddenly, the reaction stopped, and no matter how much more vinegar he added, the bubbling would not start again. Explain why this happened.

08-Exc 17-3-1A

Get the bottles from box 08-Exc 17-3-1A. Test each solution with litmus, using clean glass stirring rods. After the number of each solution, indicate whether the solution is an acid, a base, or neither.

Jean used pH paper and found the pH of samples of acid solutions as shown in the chart below. **08-Exc 17-3-2A**

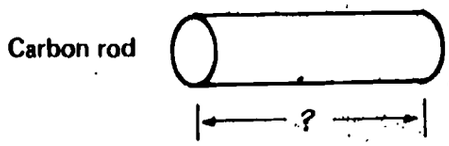
SAMPLE LETTER	pH
a	6
b	3
c	2
d	4
e	5

1. Which solution has the highest hydrogen ion (H^+ ion) concentration?
2. Which solution is the strongest acid?

Get the lettered bottles from box 08-Exc 17-3-3, the pH paper, the pH color scale, and 5 clean glass stirring rods. Copy the list of solutions below. Match each item with the letter of the bottle of solution it describes. **08-Exc 17-3-3A**

1. Acid, strong
2. Acid, weak
3. Neutral
4. Base, weak
5. Base, strong

Below is a diagram of a carbon rod. Use a metric ruler to measure its length correctly to the nearest 0.1 cm. **09-Core-1A**



Get the following supplies and equipment from the supply area. **09-Core-2A**

- 1 50-ml beaker
- 1 strip of zinc
- 1 strip of copper
- 20 ml of HCl (0.1M)
- 2 test leads
- 1 voltmeter

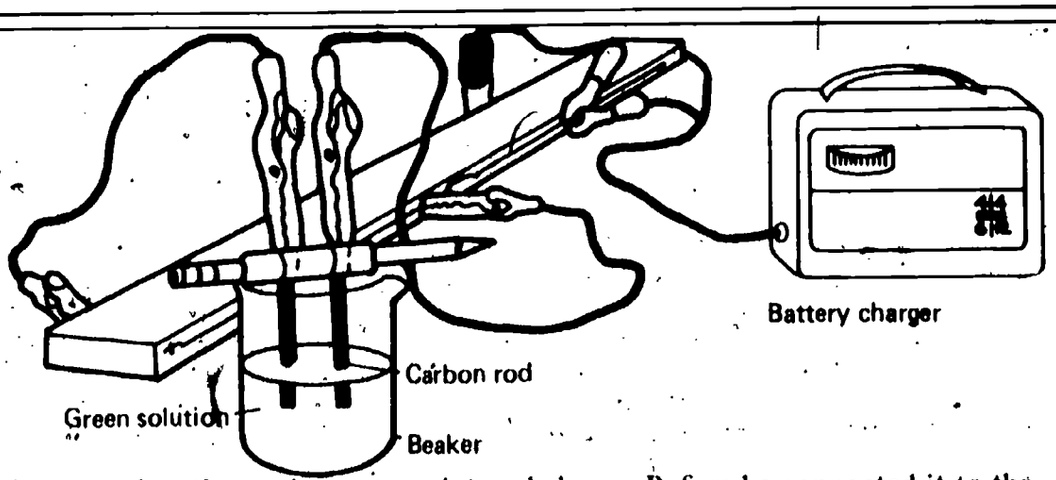
Set up a chemical system which might produce electricity.

1. Does it produce electricity?
2. How do you know whether or not this system produces electricity?

Select the letter of the correct answer. Once a battery has been charged, in what form is the energy stored in the battery? **09-Core-3A**

a. Electrical
b. Sound
c. Chemical
d. Mechanical
e. Heat

09-Core-4A



Monty put together the equipment as pictured above. Before he connected it to the battery charger, he let it sit for five minutes. He noted that both carbon rods were black and the solution was deep green. After the system had been connected for four minutes, he noticed that one of the rods had become light gray and the solution was much lighter.

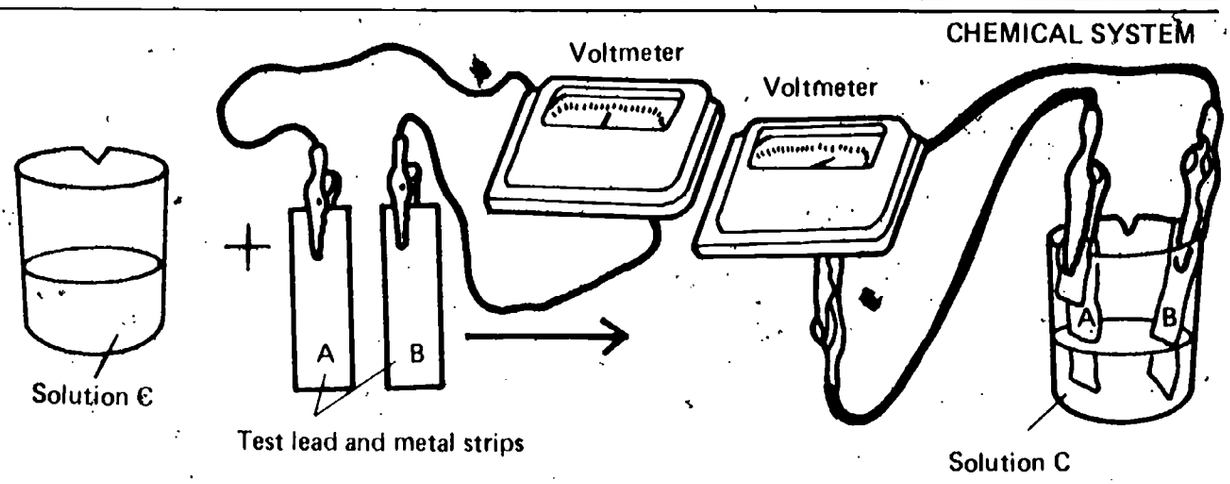
1. What kind of change occurred?
2. What kind of energy caused it?

09-Core-5A

In Activity 18-3, you put two silver-gray lead strips into a beaker of colorless sodium sulfate (Na_2SO_4) solution. Then you passed an electrical current through the system and a brown material and a gray-white material formed. The reactant materials were different from the product materials.

1. Were new particles (atoms) formed?
2. If so, name them. If not, explain how the brown stuff came into being although the reactants were so different from it.

09-Core-6A

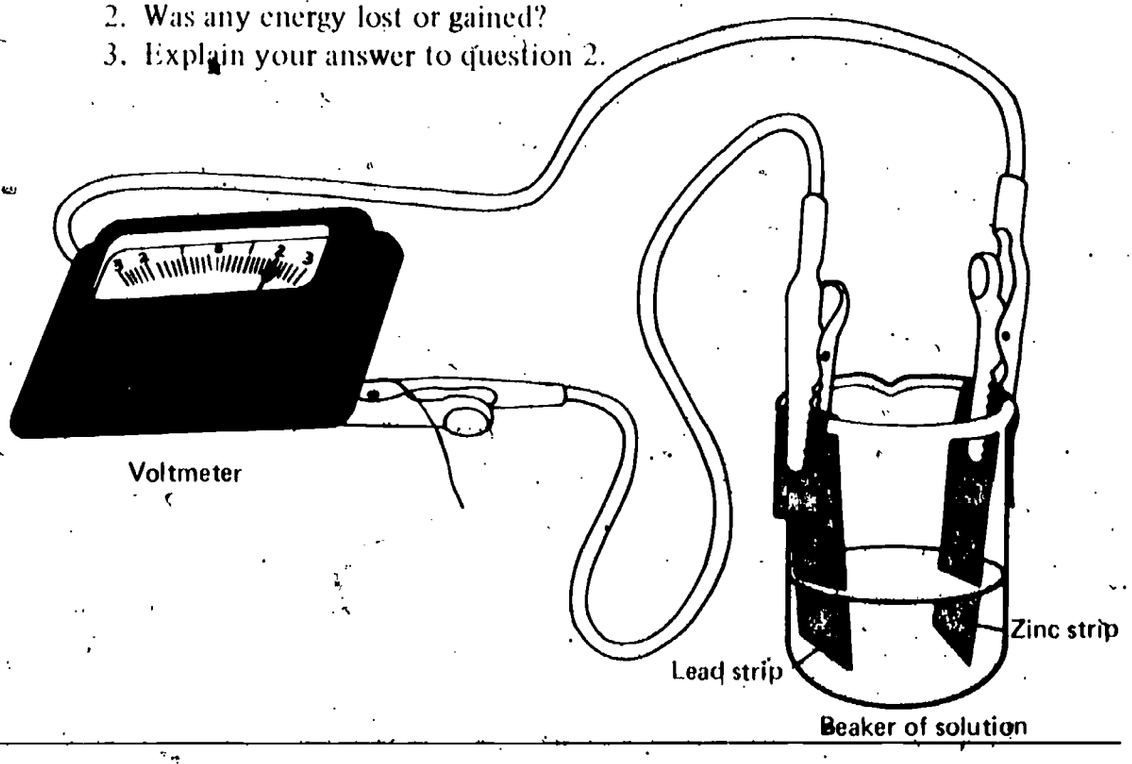


List five things you could observe which would indicate that a change is taking place in the chemical energy of a system like the one diagramed above. (Hint: Some of the observations you could make would require additional ISCS equipment.)

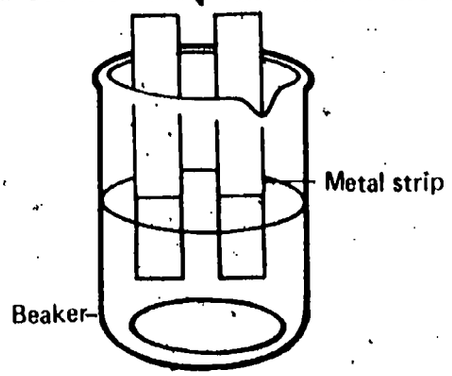
09-Core-7A

Linda put two different metal strips into a solution and connected them to a voltmeter, as shown in the diagram. The meter showed that electrical energy was being produced.

1. What was happening to the chemical energy of the system?
2. Was any energy lost or gained?
3. Explain your answer to question 2.



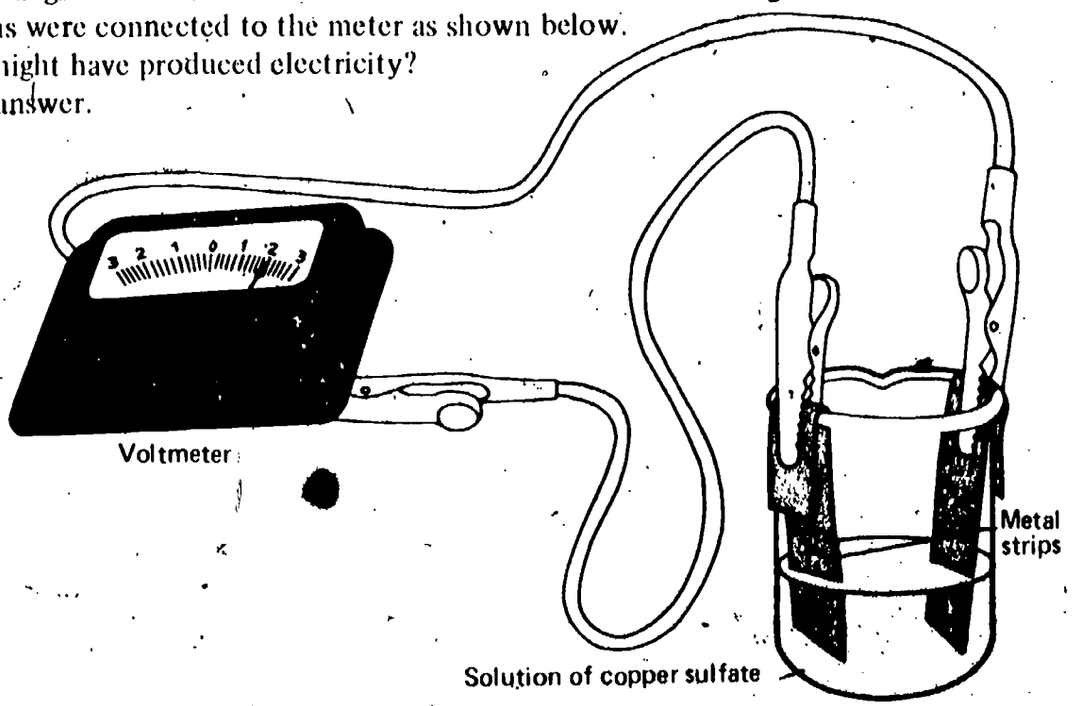
Don put two strips of the same gray metal into a light green solution. He charged the system on the charger. One of the strips turned red-brown and the other turned greenish. The solution became colorless. He disconnected the system from the charger. Then he connected the strips to a motor, and the motor started. Describe the visible changes that would occur in the beaker as the motor continued to run. **09-Core-8A**



Bob has a radio which contains several rechargeable batteries. Occasionally the batteries must be recharged. Name the process which describes the changes involving the particles inside a battery when it is charged or discharged. **09-Core-9A**

George put two nickel strips into a solution of copper sulfate. He observed no changes in the system. Sam put a copper and a magnesium strip into a copper sulfate solution. He observed changes in the color of the solution and the size of the magnesium strip. The systems were connected to the meter as shown below. **09-Core-10A**

1. Whose setup might have produced electricity?
2. Explain your answer.



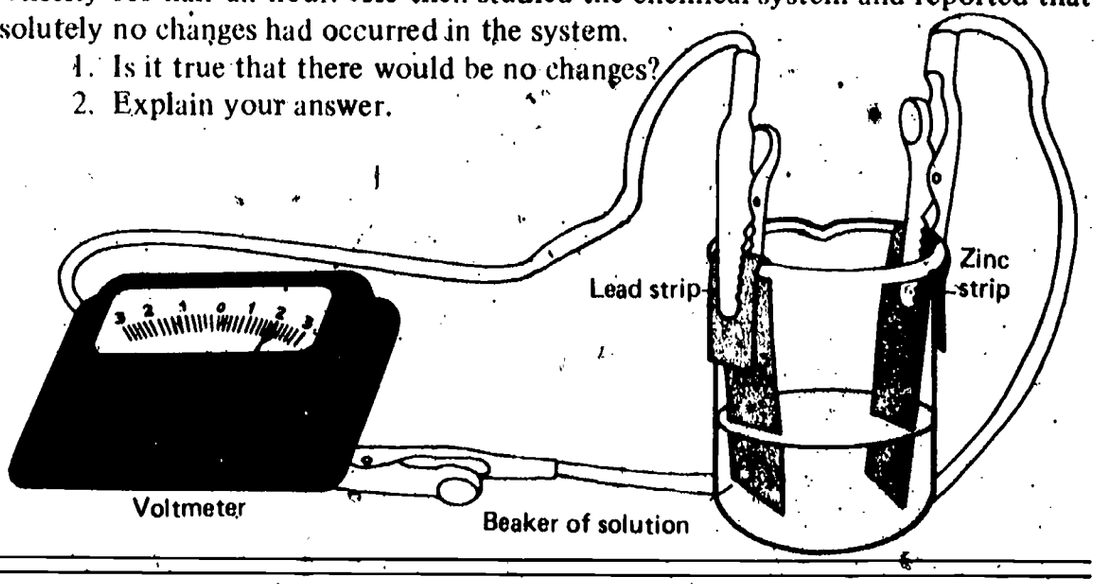
Mr. Jones is having his auto battery recharged, using a charger which is very much like Iggy's. **09-Core-11A**

1. What kind of energy is used to charge the battery?
2. What kind of energy does the battery contain after it is disconnected from the charger?
3. What kind of energy does the battery give off when it is in use?

09-Core-12A

Kevin set up the chemical system shown below. He observed the system producing electricity for half an hour. He then studied the chemical system and reported that absolutely no changes had occurred in the system.

1. Is it true that there would be no changes?
2. Explain your answer.



09-Core-13A

Iggy has operationally defined *work*. Write on your answer sheet the letters of any of the items below which fit his definition.

a. Thinking about the answers to this check
b. Dissolving a solid in a liquid
c. Recombining particles in a chemical reaction
d. Pushing a book across the desk
e. Pushing against a solid wall

09-Core-14A

Roy took his go-cart battery to the garage to get it charged. He found out from the mechanic that it took more electrical energy to charge the battery than he could get back from it.

1. Was energy destroyed or used up in the charging process?
2. Explain your answer.

09-Core-15A

Consider the following reaction.

REACTANTS → PRODUCTS

lye + hydrochloric acid → salt + water + heat energy released

1. From the information given, the chemical energy of the reactants is (less than, equal to, or greater than) the chemical energy of the products.
2. Explain your answer.

09-Core-16A

Roy noted that the temperature of a liquid dropped when a solid was dissolved in it. On your answer sheet, write the letter of the correct conclusion about the energy in the system.

a. The energy in the system had been used up and no longer existed.
b. The energy in the system had been destroyed.
c. The energy in the system had been changed into another form.
d. Both a and c are correct.
e. Both a and b are correct.

In an insulated Styrofoam cup, John dissolved 10 g of potassium nitrate in 20 grams of water which was at 24°C. The temperature of the final solution was 22°C. The amount of energy present in the materials before dissolving was (less than, equal to, greater than) the energy present in the 30 grams of matter after dissolving. **09-Core-17A**

Get the white copper sulfate in jar 09-Core-18. Put enough of it into a test tube to cover the bottom. Hold the test tube so you can feel the bottom, and add 10 drops of water slowly. **09-Core-18A**

1. Did a chemical reaction occur?
2. Did the particles combine or did they separate?
3. How can you tell?

Rhonda had a beaker of barium chloride solution and a beaker of sulfuric acid. Both solutions had a temperature of 28°C. When she mixed them, a white solid formed and the temperature rose to 30°C. According to the particle model, what caused the temperature increase? **09-Core-19A**

John dissolves some solid salt (NaCl) in water, and the temperature of the water drops 3°C. According to your particle model, what causes a temperature drop to occur when the NaCl dissolves? **09-Core-20A**

A 10 g mass of calcium chloride contains a certain amount of stored energy in the form of chemical energy. How could you release some of this chemical energy? Select your answer from the choices below. **09-Core-21A**

a. The 10 g mass can be powdered.
b. The 10 g mass can be vaporized.
c. The 10 g mass can be reacted to form a different substance.
d. None of the above are correct.
e. All of the above are correct.

ATP is a compound found in your body. It contains a great deal of chemical energy. What causes ATP or any compound to give up its chemical energy? **09-Core-22A**

In the next chapter, you will be using two dangerous liquids Winkler solution and concentrated sulfuric acid. Assume the two jars found in box 09-Core-23 contain these two liquids. Gather the materials necessary to mix 5 drops of the acid with 10 ml of Winkler solution. Ask your teacher to observe you. Mix the liquids and report your observations. **09-Core-23A**

In the next chapter you will be working with Winkler solutions and concentrated sulfuric acid. These are very dangerous chemicals. List three things that should be done if one of these solutions is spilled on someone. **09-Core-24A**

09-Exc 18-1-1A In Excursion 18-1, you were to assemble a lead chemical cell. After it was assembled, it couldn't give off electrical energy to light the bulb. It had to be charged first. Why didn't the system give off energy until it was charged?

09-Exc 18-2-1A Show your teacher the procedure you developed for Excursion 18-2. Your task is to defend what you did or to make a satisfactory change in any part of it that your teacher objects to.

09-Exc 19-1-1A Below is a list of energy conversions. Choose any four of them. Write the numbers of your four selected energy conversions on your paper, and then cite an example after each.

1. Electrical to sound
2. Electrical to chemical
3. Electrical to mechanical (motion)
4. Chemical to light
5. Chemical to electrical
6. Motion energy to heat

09-Exc 19-2-2A Kathy made the four solutions shown in the chart below. On your answer sheet, state after the number of each reaction whether it is endothermic or exothermic.

REACTION	SOLID ADDED TO WATER	WATER TEMP. (in °C)	SOLUTION TEMP. (in °C)
1	KOH	22	28
2	NaCl	24	23
3	$NaNO_3$	23	21
4	LiCl	25	27

09-Exc 19-2-2A When a solid like NH_4Cl, which is made up of ions, dissolves in water, two processes occur which involve energy.

1. Name the two processes and tell what is occurring in each.
2. The temperature of the water drops 2 degrees during the dissolving process. Which of the two processes mentioned in question 1 involves the greater amount of energy in this instance?

Preparing for their experiments with ICR's and yeast beasts, three students did the following: **10-Core-1A**

John washed all his glassware with soapy water. He did not rinse them, but he dried them carefully with paper towels.

Sam used the glassware right off the shelf.

Ed washed the glassware with tap water and then with distilled water.

1. Which student used the best procedure?
2. What is wrong with both of the other procedures?

Suppose you were given three water samples and were asked which sample contained the most dissolved oxygen. You would add Winkler solutions #1 and #2, starch, H_2SO_4, and $Na_2S_2O_3$. **10-Core-2A**

1. What data would you collect?
2. How would the data tell you which sample contained the most oxygen?

You have been studying reactions involving oxygen. What would you need to know about a substance like oxygen to write an operational definition for it? **10-Core-3A**

Open your book to Chapter 20 and use it to help you write an operational definition for *dissolved oxygen.* **10-Core-4A**

In Chapters 20 and 21, you studied ICR's and their reaction with oxygen to produce carbon dioxide. In each activity you were told to use jars and to cap them tightly. Before this you have used beakers. What is there about capping the jars that was important to your activity? **10-Core-5A**

Yesterday, Bob used a procedure identical to that used in jar 2 below. He found that it took 30 drops of $Na_2S_2O_3$ to remove the color from a mixture of 2 drops of H_2O_2, 100 ml of water, Winkler solutions, H_2SO_4, and starch which he had just made. Today, he did the following, using jars 1 and 2. **10-Core-6A**

Jar 1

1. Put in 100 ml water.
2. Added 2 drops H_2O_2.
3. Added 3 ICR's, and capped the jar.
4. Waited 12 minutes.
5. Removed ICR's.
6. Added Winkler solutions and H_2SO_4.
7. Added 4 drops of $Na_2S_2O_3$.
8. Added 1 drop of starch solution.
9. Added 8 drops of $Na_2S_2O_3$ to remove color.

Jar 2

1. Put in 100 ml of water.
2. Added 2 drops H_2O_2.
3. Added nothing, but capped the jar.
4. Waited 12 minutes.
5. Removed nothing.
6. Added Winkler solutions and H_2SO_4.
7. Added 8 drops of $Na_2S_2O_3$.
8. Added 1 drop of starch solution.
9. Added 22 drops of $Na_2S_2O_3$ to remove color.

1. What term describes jar 2 as it is used by Bob today in this activity?
2. Since Bob recorded his results yesterday for the procedure used in jar 2, why did he have to do the same reaction today as part of this activity?

10-Core-7A

John and Gary each took a jar into which they put two ICR's with 100 ml of water (H_2O) and 3 drops of hydrogen peroxide (H_2O_2). After ten minutes, John took the ICR's out of his jar. Gary forgot to watch the clock and removed his ICR's from the water after 18 minutes. They tested the water for amounts of oxygen and carbon dioxide.

1. Whose, if either, sample will contain less oxygen?
2. Whose, if either, sample will contain more carbon dioxide?
3. Explain why you answered as you did.

10-Core-8A

Daisy had a gallon of pond water. She tested a sample of it, using the Winkler test, and found that the water contained oxygen. Daisy said she was not sure if the rest of the water contained oxygen because she had tested only a small sample.

1. Does the rest of the water contain oxygen?
2. Explain your answer.

10-Core-9A

Suppose that the U.S. puts a space station with a staff of four people into orbit around the earth. The next year, the station's staff is increased to six people.

1. What will this increase in concentration of people do to the rate at which oxygen is used up?
2. What will it do to the rate at which carbon dioxide is produced?
3. Why?

10-Core-10A

Review Activities 21-8 and 21-9, in which you studied the effect of temperature on the reaction rates in the ICR's. The temperature was dropping slowly throughout the 20 minutes that the ICR's in a jar were in the ice water. Why not chill the distilled water before putting the ICR's into it so that the fish would be in cold water the entire 20 minutes?

10-Core-11A

In Rainbow Lake, the water temperature in the early spring may be 2°C. In the summer, it warms up to 24°C.

1. What effect, if any, would this warming of the water have on how often frogs must surface to take in new oxygen and release carbon dioxide?
2. Explain your answer in terms of reaction rates.

10-Core-12A

Select all of the following things which are evidences that chemical reactions take place in living things.

a. Some materials (reactants) are used up.
b. Temperatures of living things alter the rate of new material formation.
c. New materials (products) are formed.
d. Stomach acid is neutralized in definite quantities, as are other acids.
e. All of the above are correct.

Two root beer manufacturers put carbon dioxide (CO_2) into their root beer. One company's CO_2 was made by reacting HCl and limestone. The other one claimed that his product was better because the CO_2 was formed by a living system – yeast and sugar. He further claimed that because his CO_2 came from a living system, it reacted differently and could be identified. **10-Core-13A**

1. Do you agree or disagree?
2. Why?

Dr. A.R. Plain said that a chemical reaction between the reactants kerosene and oxygen makes the jets on airplanes work. **10-Core-14A**

1. From what you know about reactants in a reaction, predict what should happen to the amount of kerosene carried by the plane as it flies from Spokane to Atlanta.
2. Why does this happen?

You used $Na_2S_2O_3$ to find out how much oxygen was present in the water. Jake thinks that in different water samples the same amount of oxygen could react differently so that different amounts of $Na_2S_2O_3$ would have been required to remove the color. **10-Core-15A**

1. Do you agree or disagree?
2. Why?

You found that your ICR removed oxygen from the water. There are two possible reasons that this happened. Either ICR's only absorb and store oxygen or ICR's involve the oxygen that they absorb in a reaction. **10-Core-16A**

1. State any evidence from the activities that you have done in class that would help you decide which happened.
2. How does the evidence help you choose?

Which of the following is the *best* statement fitting both your model for chemical reactions and the results of your activities with the fish? **10-Core-17A**

a. They *suggest* that reactions take place inside of fish as they do in beakers involving only nonliving systems.
b. They *definitely show* that chemical reactions take place inside the fish as they do in beakers involving nonliving systems.
c. They *prove* that your model must be true.
d. They *establish proof* that chemical reactions do not occur inside of fish as they do in beakers involving only nonliving things.
e. b and c

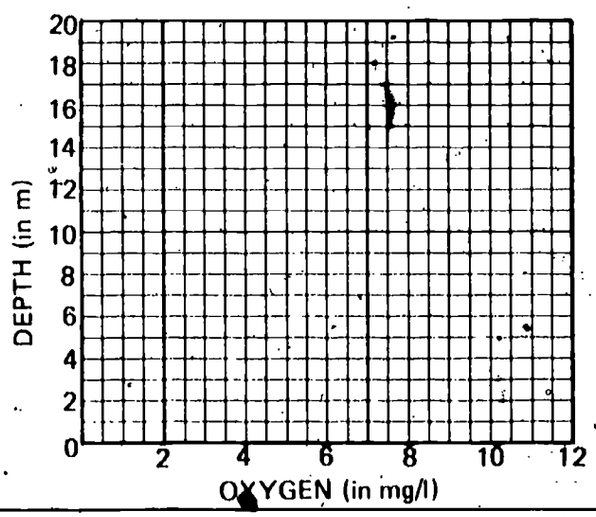
John took his temperature and found that it was 37°C. He went outside for four hours. During that time he built a snow fort and had a snowball fight. As soon as he went into the house, he took his temperature again. It was still 37°C. Certain processes convert the energy in food into heat that keeps human body temperature at 37°C. What are these processes called? **10-Core-18A**

10-Exc 21-1-1A An environmental survey team has four sample jars of equal size filled with air from four cities – New York, Indianapolis, Denver, and New Orleans. Suppose there are no Winkler solutions available. How can you find out which jar of air contains the most oxygen?

10-Exc 21-2-1A Get a piece of graph paper from your teacher, and label it as shown on the grid below. On your grid, graph the data found below about Lake Elba. Then for each kind of fish listed, place an X on the graph at the lowest depth at which it could survive. Beside the X, write the name of the fish.

DISSOLVED OXYGEN IN LAKE ELBA	
DEPTH (in m)	OXYGEN (in mg/liter)
0	10.0
2	9.8
4	9.4
6	5.2
8	2.2
10	1.5
12	1.2
14	0.8
16	0.5
18	0.5

LOWEST CONCENTRATION OF DISSOLVED OXYGEN AT WHICH FISH CAN SURVIVE FOR 24 HOURS	
TYPE OF FISH	DISSOLVED OXYGEN (in mg/l)
Pike	6.2
Sunfish	4.0
Bullhead	3.1



11-Core-1A

Get the box labeled 11-Core-1. It contains five stoppered test tubes of varying concentrations of glucose solution. Each tube also contains five drops of Benedict's solution. Arrange the tubes in order, beginning on the left with the tube with the lowest glucose concentration and ending with the tube of highest glucose concentration. Show your teacher your ordering.

11-Core-2A

Get 7 drops of each of the four solutions in the bottles in 11-Core-2A. Put each solution into a separate test tube, which is labeled with the number of the bottle you get the sample from. Your task is to judge the amount of glucose in each sample, using the procedure stated in Activities 22-12 through 22-14.

Put the solutions in order from lowest glucose content to highest glucose content. On your paper, list the numbers of the test tubes in that order.

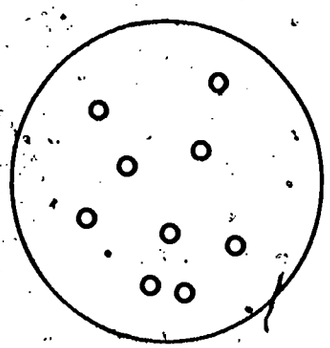
11-Core-3A

Human beings take in a great deal of oxygen which reacts and is released as carbon dioxide (CO_2). What is the source of the element carbon in the product CO_2?

a. It is created in living things.
b. It is present in our food.
c. It is produced from other elements in our body.
d. It is taken in only as burnt toast.
e. None of these are sources.

11-Core-4A

Suppose that the figure below shows the number of yeast beasts in 1/10 of a drop of a yeast solution. Calculate the number of drops you would expect to find in the entire drop of yeast solution.



11-Core-5A

Grinding the yeast beasts with sand kills the yeast beasts by tearing them apart. Yeast beasts are more effective in speeding up the breakdown of glucose into carbon dioxide and water when they are ground up than when they are whole. Why?

11-Core-6A

When yeast acts on glucose, carbon dioxide (CO_2) and water are produced. The yeast organisms get bigger and more numerous. In other words, the mass of the yeast increases. The reaction which takes place is shown below.

glucose + yeast → water + CO_2 + more yeast

1. If 6 grams of glucose were put into the test tube with the yeast, would 6 grams of the CO_2 and water be formed?
2. Explain your answer.

11-Core-7A

Case 1. Roger wanted to carry out a reaction to break down milk in a test tube. He found that he had to add a catalyst to the test tube.

Case 2. Later Roger wanted his stomach to carry out the same reaction on milk (digest it). Roger didn't have to add a catalyst to the reaction in his stomach.

Explain why Roger had to add a catalyst in the first case, but not the second.

11-Core-8A

Steak gravy on the dinner plate doesn't react with oxygen to produce noticeable amounts of carbon dioxide (CO_2), water, and heat at 37°C. Yet the same reaction produces CO_2, water, and noticeable amounts of heat at 37°C in your body. Explain why this occurs.

11-Core-9A

A maple tree used sunshine and catalysts in the following reaction.

carbon dioxide + water → glucose + oxygen

Walter claims that man will never be able to carry out this reaction in a test tube. He says the reaction requires catalysts which are produced in the tree. Therefore, even if the catalysts and the reactants are present, the catalysts will act only in green plants.

1. Do you agree or disagree with Walter?
2. Why?

11-Core-10A

In a cartoon in Chapter 23, Finny the Fish says she and Yeastie the Beast both contain catalysts, and she asks if you do too.

1. Do you contain catalysts?
2. What evidence do you have for your answer? (Hint: Candy and marshmallows release energy inside you at body temperature.)

11-Core-11A

From your study of ICR's and the yeast beasts, name three variables which you think affect reaction rates in living things.

11-Core-12A

1. Suppose that you put 3 ISCS batteries (chemical systems) into a cupboard with all the materials needed to make many other batteries, and locked the door. Tomorrow, would the number of ISCS batteries in the cupboard be fewer than 3, exactly 3, or more than 3?
2. Suppose you put 3 yeast beasts (chemical systems) into a cup of warm water and sugar. Would there be fewer than 3, exactly 3, or more than 3 yeast beasts tomorrow?
3. What is the difference between the chemical systems of batteries and yeast beasts which explains your answers to questions 1 and 2?

11-Core-13A

Jeff said, "I was warned several times not to overheat the little yeast beasts. But it wasn't the living yeast that increased the rate of the reaction. It was a catalyst inside them. If I had heated the solution more, it wouldn't have hurt the catalyst and the reaction would have gone much faster."

1. Do you agree or disagree with Jeff?
2. Why?

Select the letter of the chemical reaction in which oxygen is a reactant. **11-Core-14A**

a. Copper sulfate dissolving
b. Sodium chloride and potassium chloride dissolving in the same test tube
c. A wood splint burning
d. Alcohol boiling

What does the heat unit *kilocalorie* mean in terms of water? **11-Core-15A**

Write a definition for *calorie* in terms of water. **11-Core-16A**

A 12 gram sample of water is heated so that its temperature is raised 4°C. The change in the water's heat energy would be 12 grams X 4°C = 48. Choose the letter of the entry in the list below that includes the unit of heat in which this problem should be answered. **11-Core-17A**

a. 48 Btu
b. 48 calories
c. 48 newtons
d. 48 meters
e. 48 kilocalories

Get any equipment you need, and heat 200 ml of water for two minutes. You are to calculate the change in the heat energy of the water during the heating period. Record and label all the measurements you make. **11-Core-18A**

If h is the symbol used for height and you were asked to measure Δh, what would you measure? **11-Core-19A**

How many calories of heat energy are needed to heat 20 grams of water from 12°C to 70°C? **11-Core-20A**

Which of the following variables are important but are ignored when you use the ISCS cola-can heat-measuring device to calculate the heat of the marshmallow-oxygen reaction? **11-Core-21A**

a. Heat lost to the surrounding air
b. Heat lost to the can
c. The color of the marshmallows
d. Humidity

Select the variables which affect the amount of temperature change when a steel bar is being heated. **11-Core-22A**

a. The amount of steel being heated
b. The amount of heat supplied per minute
c. The manufacturer of the steel
d. The amount of time the heat is supplied
e. The person heating the steel bar

11-Core-23A	You put chemical energy into your body (a system). Your body converts the chemical energy into other forms of energy. List two of these other forms of energy.
11-Core-24A	The sugar found in milk contains a great deal of chemical energy. 1. What would cause the sugar to give up its chemical energy? 2. What happens to the atoms within the sugar when it gives up its chemical energy?
11-Core-25A	Candy contains a lot of energy. In what form is this energy stored?
11-Core-26A	1. Are people HCR's (human chemical reactors)? 2. If so, name three reactants and three products of an HCR. If not, state their source of energy.
11-Exc 22-1-1A	Mother Motley's recipe for rolls includes both yeast and glucose. On the basis of what you learned in Excursion 22-1, state what yeast and glucose do to dough and how they do it.
11-Exc 23-1-1A	Turpentine is a substance found in pine sap. Richard wants to determine if turpentine is a catalyst in the breakdown of starch. If it is a catalyst, what visible result should he expect to observe after mixing together the turpentine, starch, and the iodine solution?
11-Exc 24-1-1A	Curtis cooled 30 g of water by packing the container in ice. The temperature dropped from 33°C to 18°C. How many calories of heat were lost?
11-Exc 24-1-2A	One-half cup of cottage cheese contains about 101 Calories. Suppose this energy were released as heat energy. How many grams of water can this much heat energy raise 1°C?

Get your textbook, and use it to do this check. In the left-hand column are statements of five assumptions from the particle model. In the right-hand column is a list of ISCS activities that you have done, each of which involves one of these assumptions. Number your answer sheet 1 through 5. After the number of each assumption, write the letters of all of the activities listed which are related to it. A number may have more than one letter matched with it. (Hint: Read all the assumptions before reading any of the activities. If you have trouble matching any of the activities, look in your text for that activity and find out what assumptions are related to it.)

Assumptions of the Particle Model

1. All matter is made up of only 100 or so different kinds of matter particles.

2. In chemical reactions, matter particles are not created or destroyed.

3. When a chemical reaction occurs, different matter particles combine in definite numbers.

4. Some matter is composed of electrically charged particles called *ions*.

5. Molecules are made of atoms and can be broken down into atoms or simpler molecules.

Activities

a. The copper particles in a solution of copper sulfate ($CuSO_4$) move toward a negatively-charged rod, whereas the sulfate particles move toward a positively-charged rod.

b. One g of each antacid tablet neutralized about the same amount of stomach acid.

c. Shell, soda, and chalk all released carbon dioxide when HCl was poured on them.

d. When electricity is passed through water, the elements oxygen and hydrogen are released.

e. Potassium iodide (KI) solution and lead nitrate [$Pb(NO_3)_2$] solution were mixed and reacted. The combined masses of the solutions after they reacted was the same as the total masses of the two before they reacted.

f. Four different substances all contained iodine.

g. When sucrose is heated, water and carbon are formed.

h. If different quantities of zinc (Zn) were reacted with a fixed quantity of copper sulfate ($CuSO_4$), there would be either Zn or $CuSO_4$ left over when the reaction stopped.

i. Solutions of copper sulfate ($CuSO_4$) and cobalt sulfate ($CoSO_4$) let electricity pass through them to light a light bulb.

j. When sucrose is heated with HCl, fructose and glucose are formed.

12-Core-1AA

Get your textbook, and use it to do this check. In the left-hand column are statements of five assumptions from the particle model. In the right-hand column is a list of ISCS activities that you have done, each of which involves one of these assumptions. Number your answer sheet 1 through 5. After the number of each statement, write the letters of all of the activities listed which are related to it. A number may have more than one letter matched with it. (Hint: Read all the assumptions before reading any of the activities. If you have trouble matching any of the activities, look in your text for that activity and find out what assumptions are related to it.)

Assumptions of the Particle Model

1. Molecules are made of atoms and can be broken down into atoms or simpler molecules.

2. There is more than one kind of matter particle.

3. Increasing the temperature of reactants increases the rate of a reaction.

4. Increasing the concentration of reactants increases the rate of a reaction.

5. A catalyst increases the rate of a reaction when it is present in small quantities.

Activities

a. 1 ml of HCl plus 4 ml of water plus 4 pieces of shell produced carbon dioxide more slowly than 3 ml of HCl plus 4 ml of water plus 4 pieces of shell.

b. When a small amount of iron chloride ($FeCl_3$) powder was added to hydrogen peroxide (H_2O_2), oxygen gas was released more rapidly.

c. The breakdown of glucose into carbon dioxide and water went faster when the insides of ground-up yeast beasts were added to the reaction.

d. Oxalic acid ($H_2C_2O_4$) and potassium permanganate ($KMnO_4$) turn from purple to a golden color faster when hot than when cold.

e. When electricity is passed through water, the elements oxygen and hydrogen are released.

f. Two goldfish used up more oxygen than one.

g. Heated HCl and shell reacted faster than cold HCl and shell.

h. HCl reacts differently with zinc (Zn), rock, and shell.

i. When sucrose is heated, water and carbon are formed.

j. When a small piece of copper was added to a mixture of potassium iodide (KI) and potassium persulfate ($K_2S_2O_8$) solutions, it took less time for the mixture to turn blue-black than when the copper wasn't present.